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Review Article

Canadian Stroke Best Practice Recommendations: Acute Stroke Management, 7th Edition Practice Guidelines Update, 2022

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ABSTRACT: The 2022 update of the *Canadian Stroke Best Practice Recommendations (CSBPR) for Acute Stroke Management*, 7th edition, is a comprehensive summary of current evidence-based recommendations, appropriate for use by an interdisciplinary team of healthcare providers and system planners caring for persons with an acute stroke or transient ischemic attack. These recommendations are a timely opportunity to reassess current processes to ensure efficient access to acute stroke diagnostics, treatments, and management strategies, proven to reduce mortality and morbidity. The topics covered include prehospital care, emergency department care, intravenous thrombolysis and endovascular thrombectomy (EVT), prevention and management of inhospital complications, vascular risk factor reduction, early rehabilitation, and end-of-life care. These recommendations pertain primarily to an acute *ischemic* vascular event. Notable changes in the 7th edition include recommendations pertaining the use of tenecteplase, thrombolysis as a bridging therapy prior to mechanical thrombectomy, dual antiplatelet therapy for stroke prevention,[1] the management of symptomatic intracerebral hemorrhage following thrombolysis, acute stroke imaging, care of patients undergoing EVT, medical assistance in dying, and virtual stroke care. An explicit effort was made to address sex and gender differences wherever possible. The theme of the 7th edition of the CSBPR is building connections to optimize individual outcomes, recognizing that many people who present with acute stroke often also have multiple comorbid conditions, are medically more complex, and require a coordinated interdisciplinary approach for optimal recovery. Additional materials to support timely implementation and quality monitoring of these recommendations are available at www.strokebestpractices.ca.

RÉSUMÉ : Recommandations canadiennes pour les pratiques optimales de soins de l'AVC : prise en charge de l'AVC en phase aiguë, 7e édition, mise à jour des lignes directrices de pratique 2022. La version mise à jour de 2022 de la section des *Recommandations canadiennes*

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pour les pratiques optimales de soins de l'AVC portant sur la prise en charge de l'AVC en phase aiguë (septième édition) est un résumé complet des recommandations actuelles fondées sur des données probantes. Son utilisation est pertinente pour une équipe interdisciplinaire de dispensateurs de soins de santé et de planificateurs du système de santé qui s'occupent de patients ayant subi un AVC en phase aiguë ou un accident ischémique transitoire (AIT). Ces recommandations sont l'occasion idéale de réévaluer les processus actuels afin de garantir un accès rapide aux diagnostics, aux traitements et aux stratégies de prise en charge de l'AVC en phase aiguë, qui s'avèrent efficaces pour réduire la mortalité et la morbidité. Les sujets abordés comprennent les soins préhospitaliers; les soins au service des urgences; la thrombolyse intraveineuse et la thrombectomie endovasculaire; la prévention et la prise en charge des complications en milieu hospitalier; la réduction des facteurs de risque vasculaire; la réadaptation précoce; et les soins de fin de vie. Ces recommandations se rapportent principalement à un accident vasculaire *ischémique* aigu. Les changements notables apportés à cette septième édition comprennent des recommandations concernant l'utilisation de la ténectéplase; la thrombolyse comme traitement de transition avant une thrombectomie mécanique; la bithérapie antiplaquettaire pour la prévention de l'AVC1; la prise en charge de l'hémorragie intracérébrale (HI) symptomatique après une thrombolyse; l'imagerie de l'AVC en phase aiguë; les soins aux patients à qui l'on administre une thrombectomie endovasculaire; l'aide médicale à mourir (AMM); et les soins virtuels de l'AVC. Des efforts importants ont été déployés pour aborder les différences liées au sexe et au genre dans la mesure du possible. Le thème de la septième édition des *Recommandations* est « établir des liens pour optimiser les résultats individuels », mettant l'accent sur le fait suivant : de nombreuses personnes ayant subi un AVC en phase aiguë présentent souvent plusieurs troubles concomitants; leur cas est plus complexe sur le plan médical, et elles nécessitent une approche interdisciplinaire coordonnée pour obtenir un rétablissement optimal. Des documents supplémentaires pour soutenir la mise en oeuvre en temps opportun et le suivi de la qualité de ces recommandations sont accessibles à www.pratiquesoptimalesavc.ca.

Keywords: Stroke; Transient ischemic attack; Practice guideline; Thrombolytic therapy; Thrombectomy; Stroke units; Vascular imaging; Emergency medical services

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Introduction

Stroke prevention, treatment, and recovery have completely transformed over the past several decades due to research breakthroughs, increased awareness, and improvements to systems of care. Canada continues to be a world leader in driving innovation and change across the stroke continuum of care. In Canada, in 2017, there were 108,707 hospital visits for an acute stroke event,[2] and stroke remains a leading cause of adult disability with over 878,000 people living in Canada with the consequences of stroke.[3] In Canada, stroke systems of care have been growing since the late 1990s when acute thrombolysis became available. Currently, 232 hospitals (35%) are capable of providing acute thrombolysis, and this number now includes 155 hospitals with dedicated stroke teams and 95 acute stroke units. Twenty-five hospitals in Canada provide endovascular thrombectomy (EVT).[4] The global pandemic caused by the COVID-19 virus brought increased risk and worse outcomes for people with stroke and impacted response times by both the public and healthcare providers.[5–8]

The 7th update of the Canadian Stroke Best Practice Recommendations (CSBPR) for Acute Stroke Management is a timely opportunity to reassess current processes to ensure efficient access to acute stroke diagnostics, treatments, and management strategies, which have proven to reduce mortality and morbidity. The topics covered include those related to prehospital care, emergency department (ED) care, acute treatments with intravenous thrombolysis and EVT, the prevention and management in hospital complications, vascular risk factor reduction strategies, early rehabilitation, and end-of-life care. The theme of the 7th edition of this CSBPR is building connections to optimize individual outcomes. Following an acute stroke, persons often present with multiple comorbid conditions, some of which may have contributed to their stroke, some that are the consequence of their stroke, and some which are unrelated. In many cases, comorbidities such as hypertension, carotid stenosis, and patent foramen ovale (PFO) may be first detected at the time of stroke. Regardless of the etiology, persons presenting with stroke and multiple comorbidities are more complex and are at risk of worse outcomes. These comorbid conditions must be considered within the treatment and care planning process to ensure effective and person-centered care.

The CSBPRs are intended to provide up-to-date evidence-based guidelines for the prevention and management of stroke and to promote optimal recovery and reintegration for people who have experienced stroke, including patients, families, and caregivers. The goal of disseminating and implementing these recommendations is to optimize evidence-based stroke care across Canada to reduce practice variations in care delivery and to narrow the gap between current knowledge and clinical practice. These recommendations have been developed in collaboration with the Canadian Stroke Consortium, Canada's national organization of stroke physicians. The recommendations are applicable to all healthcare providers, health system leaders and planners, and people living with stroke. The CSBPR Acute Stroke Management 2022, 7th edition supersedes all recommendations contained in the 2018 CSBPR 6th edition of Acute Stroke Management.[9]

Guideline Development Methodology

The CSBPR development and update process follows a rigorous framework[10,11] and addresses all criteria defined within the Appraisal of Guidelines for Research and Evaluation II (AGREE II) Instrument components.[12] The methodology for development and updates to the CSBPR has been previously published,[13] and detailed methodology can be found on our Canadian Stroke Best Practices website at www.strokebestpractices.ca. An interdisciplinary group of experts was convened and participated in reviewing, drafting, and revising all recommendation statements. Eight people with lived experience of stroke (seven people with stroke and one caregiver) also actively participated in the review and update process as part of our acute stroke community consultation and review panel.[14]

Searches were conducted by experienced personnel to identify peer-reviewed literature that examined each topic area addressed

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in the current module. Systematic reviews, meta-analyses, randomized controlled trials, and observational studies were included, as available. The literature for this module was current to September 2022. Following a standardized abstraction format, evidence tables were constructed including content from selected studies and provided to the writing group for review. The writing group discussed and debated the strength, importance, clinical relevance, and applicability of the evidence and, through consensus, developed a draft set of proposed recommendations. During this process, additional literature may have been identified and used to develop a final set of proposed recommendations. Evidence levels were assigned based on the quality of available evidence, using the Grading of Recommendations, Assessment, Development and Evaluations (GRADE) system.[15–17] Expert opinion was used to formulate recommendations in the absence of evidence. These guidelines have undergone extensive internal and external review, and consensus was achieved for all content. For additional details of the methodology and additional materials to support these recommendations, including rationales, system implications, performance measures, knowledge translation and implementation tools, evidence tables, and an extended summary of the evidence, please visit: www.strokebestpractices.ca. Supplemental online materials are available with this publication to support many of the recommendations included.

Summary of Changes and Updates in the *Acute Stroke Management Stroke*, 7th Edition, 2022

Significant updates and new additions to the CSBPR for Acute Stroke Management, 7th edition 2022 are based, in part, on the results from several new, important clinical trials. Notable changes in the 7th edition include recommendations pertaining the use of tenecteplase, thrombolysis as a bridging therapy prior to mechanical thrombectomy, dual antiplatelet therapy (DAPT) for stroke prevention,[1] the management of symptomatic intracerebral hemorrhage (ICH) following thrombolysis, acute stroke imaging (Section 4), pre- and post-op care of patients undergoing EVT (Section 5), medical assistance in dying (MAiD) (Section 11), and virtual stroke care in the ED and inpatient care (Sections 4 and 8). An explicit effort was made to address sex and gender differences wherever possible. The first four sections of this guideline pertain to all people presenting with signs of acute stroke or TIA. The remaining sections pertain largely to the management of acute ischemic stroke and TIA. Guidelines for the management of patients with ICH were released in 2020,[18] while those for subarachnoid hemorrhage and cerebral venous thrombosis are in development.

Acute Stroke Management Recommendations, 7th Edition, Update 2022

Note, please refer to online Supplemental Material accompanying these recommendations for additional definitions, information, inclusion criteria, and other implementation content. This manuscript has been translated into French and is also available as an online supplement.

Section 1: Stroke Awareness, Recognition, and Response

Many members of the general public are unable to recognize the signs and symptoms of a stroke, or they attribute them to a less serious health issue.[19–21] While 61% of the population in Canada knows at least one sign of stroke, only 33% know at least two and only 10% know all three, based on the FAST (Face, Arms, Speech, Time) mnemonic.[22] The failure to recognize the signs of an acute stroke, either by the persons witnessing one or the person experiencing one, can delay contact with emergency services, which may in turn decrease a patient's opportunity to receive time-sensitive treatments. The number of public health campaigns designed to increase recognition of the signs and symptoms of stroke has increased over the past decade. One of the best recognized programs in the healthcare community is FAST. The results of a systematic review[23] suggest that stroke education using mass media campaigns can increase the likelihood of symptom recognition by 20% and increase the likelihood that persons would call emergency services by 19%. Mass media campaigns have also been shown to be associated with increases in the use of thrombolytic agents following acute stroke.[24]

1. Stroke Awareness, Recognition, and Response Recommendations 2022

i. Organized and integrated stroke systems of care should be established and sustained in every health region in Canada to enable rapid emergency stroke management, including a public awareness campaign, public emergency system (such as 9-1-1), and monitoring systems that consider equity, age, sex, and gender diverse populations [Strong recommendation; Moderate quality of evidence].

ii. All members of the public and all healthcare providers should be educated that stroke is a medical emergency [Strong recommendation; Low quality of evidence].

   a. Education for the public and healthcare providers should include information that stroke can affect persons of any age including newborns, children, and adults. [Strong recommendation; Low quality of evidence].

   b. Education for the public and healthcare providers should emphasize the benefits of early emergency treatment [Strong recommendation; Moderate quality of evidence].

iii. Awareness campaigns and education for the public and healthcare providers should emphasize recognition of the signs and symptoms of stroke, including the use of an acronym such as FAST (Face, Arms, Speech, Time) to facilitate awareness of and easy recall of these signs [Strong recommendation; Moderate quality of evidence].

   a. The public and healthcare providers should ***respond immediately*** when witnessing someone experiencing signs or symptoms of stroke by calling 9-1-1 or their local emergency number [Strong recommendation; Moderate quality of evidence], even if the signs or symptoms resolve. *Refer to online Supplemental Materials, Box 1B for additional information on discussions with emergency medical services (EMS) dispatch.*

   b. The public should be aware of the importance of following instructions from the EMS dispatch centre [Strong recommendation; Low quality of evidence]. *Refer to Section 3 Emergency Medical Services Management of Acute Stroke for additional information.*

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Section 2: Triage and Initial Diagnostic Evaluation of Transient Ischemic Attack (TIA) and Non-Disabling Stroke

People experiencing signs of stroke require rapid assessment, diagnosis, and determination of risk for a recurrent stroke. Patients diagnosed to have TIA, or subacute, non-disabling ischemic strokes who are not candidates for hyperacute treatment with intravenous thrombolysis and/or EVT still require timely assessment and management, which can often be provided in an outpatient setting. The goal of outpatient management is to rapidly identify neurovascular risk factors, which may have precipitated the index event, and to initiate treatments to reduce the risk of recurrent events. The increased use and availability of sensitive neuroimaging to identify minor events as well as the increased use of antiplatelet agents, anticoagulants, antihypertensive agents, lipid-lowering agents, and carotid revascularization has been shown to significantly reduce the risk of major stroke after an initial minor event in recent years. In the TIARegistry.Org group study, 78.4% of patients were seen by a stroke specialist within 24 h of the event.[25] Most patients received key urgent investigations before discharge, and appropriate treatments were initiated. For example, 5.0% of patients received a new diagnosis of atrial fibrillation, of which 66.8% received anticoagulant therapy before discharge. Carotid stenosis of ≥50% was found in 15.5% of patients, of which 26.9% underwent carotid revascularization

2. Triage and Initial Diagnostic Evaluation of Transient Ischemic Attack and Non-Disabling Stroke Recommendations 2022

Notes

- Section 2 *recommendations pertain to the initial management of patients with a suspected acute transient ischemic attack (TIA) or acute ischemic stroke* ***who are not candidates*** *for acute thrombolysis or endovascular intervention. For patients with suspected acute stroke that warrant hyperacute assessment to determine eligibility for intravenous thrombolysis and endovascular thrombectomy (EVT), refer to the current CSBPR Acute Stroke Management treatment recommendations, Sections 4 and 5.*
- *Refer to online Supplemental Materials for additional notes about this section.*

2.0

i. Patients with acute stroke or TIA who present to an outpatient setting (such as primary care) or to a hospital should undergo clinical evaluation by a healthcare professional with stroke expertise to determine the patient's risk for recurrent stroke and initiate appropriate and timely investigations and management strategies [Strong recommendation; Moderate quality of evidence].

ii. Shared decision-making should take into account patient values, preferences, health goals, medical complexity, social determinants of health, health literacy, and health needs [Strong recommendation; Low quality of evidence].

2.1 HIGH Risk for Recurrent Stroke (Symptom Onset Within Last 48 hours)

i. Individuals presenting within 48 hours of symptoms consistent with a new acute stroke or TIA (especially transient focal motor or speech symptoms, or persistent stroke symptoms) are ***at the highest risk for recurrent stroke*** and should be immediately sent to an emergency department (refer to Clinical Consideration 2.1[3]) with a capacity for stroke care, which includes on-site brain imaging and ideally access to acute stroke treatments [Strong recommendation; Moderate quality of evidence].

ii. Urgent brain imaging (computerized tomography [CT] or magnetic resonance imaging [MRI]) with concurrent neurovascular imaging (e.g., CT angiography [CTA] or MR angiography [MRA]) should be completed as soon as possible and before discharge from the emergency department [Strong recommendation; Moderate quality of evidence].

iii. Patients presenting after 48 hours from the onset of an acute stroke or TIA should receive a comprehensive clinical evaluation and investigations as soon as possible by a healthcare professional with stroke expertise [Strong recommendation; Low quality of evidence]. *Refer to Section 2.2 for more information on investigations.*

Section 2.1 Clinical Considerations

1. Referral to a healthcare professional with stroke expertise should be considered for patients with a suspected uncommon cause of stroke, including for young patients with stroke (e.g., <45 years of age)[27] family history of young-onset stroke; suspected cerebral vasculitis or other intracranial arteriopathy/vasculopathy; or suspected hereditary or acquired thrombophilia.
2. Patients with symptoms of vertebrobasilar ischemia may present with fluctuating brainstem/cerebellar type symptoms (e.g., diplopia, dysarthria, dysphagia, non-positional vertigo, ataxia; rarely as isolated symptoms) over a longer time course (i.e., >48 hours) and can be mistaken for stroke mimics; however, these patients also require urgent assessment, neurovascular imaging, and management as these types of strokes can have a high morbidity. Consultation with a healthcare professional with stroke expertise is strongly encouraged.
3. **Setting**: In some regions, urgent/rapid TIA clinics are available that have rapid access to diagnostic services and specialist assessment and management. These clinics may be considered an appropriate referral option for patients with TIA and minor stroke.

2.2 Brain and Vascular Imaging

i. Brain imaging (CT or MRI) and non-invasive vascular imaging (CTA or MRA) from aortic arch to vertex should be completed as soon as possible following acute disabling or non-disabling stroke, or TIA [Strong recommendation; Moderate quality of evidence].

   a. CTA of the head and neck from aortic arch to vertex, performed at the time of initial brain CT is recommended as an ideal way to assess both extracranial and intracranial circulation [Strong recommendation; Moderate quality of evidence]. *Note: Some facilities may not have CTA readily available and so the timing and type of vascular imaging will need to be based on available resources and local practice protocols.*

   b. Neurovascular imaging is recommended to identify patients with significant symptomatic extracranial carotid artery stenosis (i.e., 50%–99% stenosis), which should trigger an urgent referral for potential carotid revascularization [Strong recommendation; High quality of evidence].

   c. CTA is the first-line vascular imaging test for stroke or TIA patients. If CTA is not possible, MRA and carotid ultrasound for extracranial vascular imaging are reasonable alternatives as first-line tests for assessment of carotid vessels, and selection should be based on availability and patient characteristics [*Conditional recommendation*; Low quality of evidence].

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2. Triage and Initial Diagnostic Evaluation of Transient Ischemic Attack and Non-Disabling Stroke Recommendations 2022

Section 2.2 Clinical Considerations

1. MRI brain scanning is superior to head CT in terms of diagnostic sensitivity for identifying small ischemic lesions in patients presenting clinically with a TIA or minor stroke and can provide additional information to guide decisions about diagnosis, prognosis, and treatment. Decisions about MRI scanning should be based on MRI access, availability, and timing of appointments. For maximal diagnostic yield, MRI should be completed as soon as possible after the symptomatic event, ideally within 7 days of symptom onset so that diffusion-weighted imaging can identify any potential restricted diffusion changes representing infarct. MRI is particularly useful in lower-risk patients with transient symptoms where the presence of ischemia would change their management.
2. Common scenarios where urgent brain MRI can be valuable include:
    a. Normal CT head despite symptoms persisting >24 hours. If diffusion-weighted imaging MRI is negative, cerebral ischemia is unlikely.
    b. Normal CT head where there is suspected brainstem or cerebellar ischemia (CT head is relatively insensitive for detecting strokes in the posterior fossa due to bone artifact).
    c. Focal transient symptoms that are clinically atypical for ischemia.

2.3 Blood Work

i. The following laboratory investigations should be routinely considered for patients with a TIA or minor ischemic stroke as part of the initial evaluation:
    a. **Initial blood work**: Hematology (complete blood count), electrolytes, coagulation (aPTT, INR), renal function (creatinine, estimated glomerular filtration rate), random glucose, ALT [Strong recommendation; Low quality of evidence]. *Refer to online Supplemental Materials, Table 2A for full list of recommended laboratory tests.*
    b. **Additional laboratory tests** may be completed during the patient encounter or as an outpatient, including a lipid profile (fasting or non-fasting); and screening for diabetes with either a glycated hemoglobin (HbA1c), fasting glucose or 75g oral glucose tolerance test [Strong recommendation; Low quality of evidence]. *Refer to Diabetes Canada Guidelines for additional information related to glucose testing.*
    c. (NEW FOR 2022) **Giant Cell Arteritis:** If giant cell arteritis is suspected (e.g., retinal ischemia or headache), ESR or CRP should be measured [Strong recommendation; Low quality of evidence].

ii. (NEW FOR 2022) Extensive thrombophilia testing for hereditary hypercoagulable disorders is not recommended for routine investigation of a patient with arterial ischemic stroke and should be limited to selected situations [Strong recommendation; Low quality of evidence].
    a. If a hypercoagulable state is suspected, consultation with a healthcare professional with hematology or thrombosis expertise should be considered [Strong recommendation; Low quality of evidence].

2.4 Cardiac Studies

2.4A Detection of Atrial Fibrillation

i. Patients with suspected ischemic stroke or TIA should have a 12-lead electrocardiogram (ECG) to assess for atrial fibrillation, concurrent myocardial infarction, or structural heart disease (e.g., left ventricular hypertrophy) as potential causes or risk factors of stroke [Strong recommendation; Moderate quality of evidence].

ii. For patients being investigated for an acute embolic ischemic stroke or TIA, ECG monitoring for 24 hours or more is recommended as part of the initial stroke work-up to detect paroxysmal atrial fibrillation in patients who would be potential candidates for anticoagulant therapy [Strong recommendation; High quality of evidence].

iii. For patients being investigated for an embolic ischemic stroke or TIA of undetermined source whose initial short-term ECG monitoring does not reveal atrial fibrillation but a cardioembolic mechanism is suspected, continuous ECG monitoring for at least 2 weeks is recommended to improve detection of paroxysmal atrial fibrillation in selected patients aged ≥55 years who are not already receiving anticoagulant therapy but who would be potential candidates for anticoagulant therapy [Strong recommendation; High quality of evidence]. *Refer to CSBPR Secondary Prevention of Stroke module Section 7 for additional guidance in management of patients with stroke and atrial fibrillation.*[13] *Refer to the current Canadian Cardiovascular Society recommendations on atrial fibrillation.*[28]

2.4B Echocardiography

iv. Routine echocardiography is not required for all patients with stroke [Strong recommendation; Low quality of evidence].

v. Echocardiography should be considered for patients with an embolic ischemic stroke or TIA of undetermined source or when a cardioembolic etiology or paradoxical embolism is suspected [Strong recommendation; Moderate quality of evidence].

vi. For patients ≤60 years who are being investigated for an embolic ischemic stroke or TIA of undetermined source, echocardiography with saline bubble study is recommended for detection of a patent foramen ovale (PFO) if it may change patient management (i.e., in patients who would be potential candidates for PFO closure or anticoagulant therapy if a PFO were detected) [Strong recommendation; Moderate quality of evidence].
    a. Contrast-enhanced (agitated saline) transesophageal echocardiography or transcranial Doppler has greater sensitivity than transthoracic echocardiography for detection of right-to-left cardiac and extra-cardiac shunts and should be conducted when available, [Strong recommendation; Moderate quality of evidence].

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2. Triage and Initial Diagnostic Evaluation of Transient Ischemic Attack and Non-Disabling Stroke Recommendations 2022

2.5 Functional Assessment

i. Patients with stroke should be assessed for neurological impairments and functional limitations (e.g., cognitive evaluation, screening for depression, screening for dysphagia, screening for aphasia, screening for fitness to drive, need for rehabilitation therapy, assistance with activities of daily living, functional mobility) [Strong recommendation; Moderate quality of evidence]. *Refer to Rehabilitation and Recovery Following Stroke module[29] for additional information.*

ii. Patients with stroke found to have neurological impairments that could impact daily functioning should be referred to the appropriate rehabilitation specialist for in-depth assessment and management [Strong recommendation; Moderate quality of evidence].

2.6 (NEW FOR 2022) Virtual Care for Secondary Stroke Prevention

i. Secondary stroke prevention services should establish information technology infrastructure and protocols to increase and ensure access to virtual care delivery for patients who do not require in-person visits. Emphasis should be placed on considerations for those individuals who do not require in person visits such as, for patients living in rural and remote settings who do not have local access to healthcare professionals with stroke expertise [Strong recommendation; Low quality of evidence]. *Refer to CSBPR Virtual Stroke Care Implementation Toolkit for additional information at www.strokebestpractices.ca.*

ii. Clinicians should follow established/validated criteria to determine the best form of visit for each patient at each encounter (i.e., virtual or in person) based on the purpose, goals, digital literacy, and availability for each visit [Strong recommendation; Low quality of evidence]. *Refer to Heart & Stroke Virtual Care Decision Framework for additional information and criteria at www.strokebestpractices.ca*

Section 2.6 Clinical Considerations

1. Consulting sites and individual clinicians should have triage protocols and local intake criteria to ensure patients referred to their services are seen in a timely manner, especially high-risk patients described in Section 2.1.
2. The use of virtual care for stroke prevention should include decision tools to identify patients who require in-person visits and those who can reasonably be managed through virtual care, and a scheduling mechanism for virtual visits that support a collaborative team approach to care where appropriate and feasible. *Refer to Heart & Stroke Virtual Care Decision Framework for additional guidance and criteria at www.strokebestpractices.ca.*
3. A contingency plan should be established to quickly see patients in person should the need arise following a virtual care encounter. *Refer to CSBPR Virtual Stroke Care Implementation Toolkit for additional information at www.strokebestpractices.ca.*
4. Virtual care-enabled evaluations of patients for secondary stroke prevention should be modeled on the topics defined in the post-stroke checklist and core elements of stroke prevention care. *Refer to CSBPR Post Stroke Checklist for additional information at www.strokebestpractices.ca.*
5. Validated approaches to virtual neurological exams should be followed.
6. Processes should be in place to book follow-up tests, referrals, and other consultations after a virtual care visit.
7. Processes to ensure appropriate documentation and communication to other team members who may be involved in remote care should be in place.
8. Patients and their families should be encouraged to acquire home blood pressure monitors where appropriate and education or reliable resources on proper use should be provided. Mechanisms should be in place for follow-up and management of blood pressure for patients using home blood pressure devices, by either primary care providers or a stroke prevention service.
9. For timely investigations, the use of prolonged cardiac monitors, if available, that can be sent to patient's homes, self-applied, and returned by mail, should be considered.

before discharge. The 1-year estimate of risk of the primary outcome, a composite of death from cardiovascular causes, nonfatal stroke, and nonfatal acute coronary syndrome, was 6.2% (95% confidence interval [CI] 5.5–7.0%). Estimates of stroke at days 2, 7, 30, 90, and 365 were 1.5%, 2.1%, 2.8%, 3.7%, and 5.1%, respectively. These estimates were almost half of those compared with historical cohorts, possibly reflecting faster access to preventive care in the contemporary cohort. The availability of TIA outpatient clinics appears to be increasing. Based on the results of a geospatial analysis, there were 123 secondary prevention clinics in Canada, as of 2016.[26] While over 87% of the population had access to such a clinic within a 1-h drive, only 69.2% has access to a service that operates 5–7 days a week.

Section 3: Emergency Medical Services

Emergency medical services (EMS) play a critical role in prehospital assessment and management of patients with suspected stroke. Patients arriving to hospital using EMS following a stroke experience fewer delays in receiving appropriate diagnostic tests, and are more likely to receive revascularization treatments, if eligible. In 2020, 69.0% of patients with stroke admitted to hospital in Canada were transported by EMS.[30] The odds of a patient receiving treatment with intravenous thrombolysis were increased by 52% if the patient was transported by EMS and increased by 75% if a system of hospital prenotification was employed.[31] Given the time-sensitive nature of acute stroke treatment, it is imperative that patients who may be candidates for these therapies be transported directly to comprehensive stroke centers as quickly as possible and whenever possible. The 90-day outcomes of patients who received EVT following direct transport have been shown to be better than those who were first transported to a primary stroke center.[32,33] However, in a recent cluster-randomized trial[34] in which paramedics transporting patients with ischemic stroke were randomized to the PASTA pathway (including structured prehospital information collection, prompted prenotification, and structured handover of information) or standard care, there was no significant difference between groups in the proportion of patients

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3. Emergency Medical Services Management of Acute Stroke Recommendations 2022

3.0 Out-of-hospital patient management should be organized to achieve the rapid assessment and treatment of patients with suspected stroke, including rapid recognition of potential stroke symptoms, EMS mobilization, and transport to an acute care hospital with acute stroke management capability [Strong recommendation; Moderate quality of evidence].

3.1 Access to Emergency Medical Services

i. A person experiencing the signs or symptoms of stroke, or any witness, should immediately contact EMS by calling 9-1-1 or the local emergency number [Strong recommendation; Moderate quality of evidence]. *Refer to Section 1 for additional information.*

ii. EMS communications centre: All regions in Canada should implement a dispatch process through their EMS communications centres to rapidly recognize signs or symptoms of stroke (e.g., FAST: Face, Arms, Speech, Time), prioritize response to the scene, and transport the patient to a hospital capable of providing acute services for rapid diagnosis and time-sensitive treatment of stroke (such as neuroimaging, and acute thrombolysis) [Strong recommendation; Low quality of evidence].

iii. After dispatching the ambulance, it is recommended that EMS communications centre personnel provide pre-arrival instructions to the person reporting the stroke (e.g., unlock door, move pets, determine stroke symptom onset time, determine current medications), in order to expedite, optimize, and improve safety for prehospital care [*Conditional recommendation*; Low quality of evidence]. *Note: If the person experiencing the signs of stroke is the one to contact EMS, they may not be able to comply with these requests.*

3.2 Paramedic On-Scene Management

*Note: The on-scene goal is to **recognize and mobilize.** It is of the utmost importance to rapidly and safely transport suspected patients with stroke, as on-scene management for patients with stroke is limited.*

i. To minimize time to acute treatment for thrombolysis or EVT, EMS personnel should use a validated acute stroke out-of-hospital diagnostic screening tool that includes the components of FAST [Strong recommendation; Moderate quality of evidence].

   a. To optimize access to EVT, patients who demonstrate FAST signs of stroke should then undergo a valid secondary screen to assess stroke severity, which may be used to identify candidates for *direct transport to an EVT capable centre where possible* [Strong recommendation; Moderate quality of evidence]. *Note: The purpose of the second screen is to look for possible EVT candidates, such as people exhibiting signs of cortical dysfunction (e.g., aphasia, visual changes, neglect).*

   b. Screening for potential stroke and likelihood of large vessel occlusion (LVO) should be done early in the on-scene assessment. If the stroke screen is positive, all on-scene actions from that point should be focused on moving to the ambulance and beginning transport [Strong recommendation; Moderate quality of evidence].

ii. Treatments that are not immediately required could be undertaken while the patient is enroute to the hospital or after hospital arrival [Strong recommendation; Low quality of evidence].

iii. EMS personnel should obtain information from the patient, family members or other witnesses about the suspected stroke event, including presenting symptoms, time of onset or time of symptom recognition and time last known well, sequence of events, co-morbid conditions, current medications (especially anticoagulants), and any formal or informal advance directives that may influence care by EMS and in the emergency department [Strong recommendation; Moderate quality of evidence]. *Refer to online Supplemental Materials Box 3A for additional information.*

iv. On-scene time with any patient with suspected stroke should be as short as possible; ideally a median time of <20 minutes [Strong recommendation; Low quality of evidence].

v. Initial assessment provided by paramedics should include capillary blood glucose measurement [Strong recommendation; Moderate quality of evidence].

   a. Ideally capillary blood glucose measurement should be done on-scene to inform transport decisions [*Conditional recommendation*; Low quality of evidence].

vi. Prior to transport, on-scene EMS personnel should provide instructions to the patients' family, including recommending that the family member or other decision-maker accompany the patient to hospital or be accessible by phone for decision-making; confirming time last known well; and providing information about existing health conditions, current medications, and other information as needed [Strong recommendation; Low quality of evidence].

3.3 Transport of Patients with Suspected Stroke

i. Direct transport protocols should be in place to facilitate the transfer of patients with suspected acute stroke who are potentially eligible for thrombolytic and/or EVT to the most appropriate acute care hospital capable of providing services for the diagnosis and treatment of acute stroke [Strong recommendation; Moderate quality of evidence].

ii. Direct transport protocols should take into account the medical stability of the patient, last known well time, severity of the stroke, and any regional factors [Strong recommendation; Moderate quality of evidence]. *Refer to online Supplemental Materials Box 3B for additional information.*

iii. Patients with suspected stroke should be triaged by EMS as Canadian Triage Acuity Scale (CTAS) Level 2 in most cases and as a CTAS Level 1 for patients with compromised airway, breathing, or cardiovascular function [Strong recommendation; Moderate quality of evidence].

iv. **Pre-notification**: While enroute to the receiving hospital that provides acute stroke services, EMS should notify the emergency department of the incoming suspected acute stroke patient and provide sufficient details such that a "Code Stroke" can be activated at that time [Strong recommendation; Moderate quality of evidence]. *Refer to online Supplemental Materials Box 3A for additional information.*

v. Patients with suspected stroke who are considered ineligible for intravenous thrombolytic therapy or EVT (e.g., they are outside the time window) should still be transported immediately to the closest hospital capable of providing acute stroke diagnosis and management services, where assessment and determination can be made for transport to a higher level of care as appropriate [Strong recommendation; High quality of evidence].

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3. Emergency Medical Services Management of Acute Stroke Recommendations 2022
3.4 Hospital Arrival and Emergency Medical Services Handover to Emergency Department Staff
i. Transfer of care from paramedics to receiving hospital personnel should occur with minimal delay and patients with suspected acute stroke who are potentially eligible for thrombolytic therapy or EVT should receive highest priority in the emergency department triage queue [Strong recommendation; Moderate quality of evidence]. *Refer to Section 4.1 for more information.*
ii. At hospital arrival, paramedics should provide the receiving hospital with verbal and written information related to the patient's stroke onset time, last known well time, presenting symptoms, and medications, to facilitate rapid assessment and decision-making [Strong recommendation; Low quality of evidence]. *Refer to online Supplemental Materials Box 3A for more information.*
Section 3 Clinical Considerations
1. The standard window for intravenous thrombolysis is 4.5 hours and the standard time window for EVT is 6 hours. However, patients may be considered eligible beyond these windows based on clinical factors and neuroimaging findings.
2. Direct transport in many regions may take one of two potential pathways based on local or regional considerations:
a. Patients who may be eligible for intravenous thrombolysis may be directed to the closest centre, which may be a primary/advanced stroke centre or comprehensive stroke centre.
b. Patients who are likely candidates for EVT may be directed to (1) an EVT-enabled comprehensive stroke centre OR (2) a primary centre to rapidly receive intravenous thrombolysis and then be considered for transport to an EVT-enabled comprehensive stroke centre.
3. On-scene time is an important variable that EMS professionals can control and needs to be monitored closely. Time lost due to inefficient on-scene care cannot be made up during subsequent transport to hospital, regardless of the use of lights and sirens.
4. Patients should be transported by the method that allows the shortest transport time. In the event that a ground EMS response may cause significant delay in the patient transport, air transport should be considered where available.
5. Pre-notification contact with the receiving emergency department should be initiated as soon as possible; where possible, the paramedics and receiving emergency department physician or stroke team member should communicate while enroute.
6. For EVT-eligible patients, processes and or algorithms should be put in place that will easily enable a discussion to arrange for the patient to be transferred to the EVT-enabled comprehensive stroke centre in a timely manner. A three-way conference call among the referring clinician (paramedic or emergency department physician at a primary/advanced stroke centre), the receiving physician at the EVT-enabled centre, and the ambulance service involved in patient transport should support decision-making regarding direct to EVT centre or closer centre for initial imaging and assessment.
7. **Mobile Stroke Units**: The Canadian Stroke Best Practices writing group is currently unable to make a recommendation about mobile stroke units as published data on their use in the context of Canadian geography and health system organization are lacking. The group encourages further research into mobile stroke units in Canada as high-quality studies from other jurisdictions suggest that the use of these specialized units is associated with a reduced time to thrombolysis, an increased proportion of patients receiving thrombolysis, and better functional outcomes at 90 days.

who received thrombolysis (49.7% [PASTA] vs. 52.6% [standard care], adjusted odds ratio [OR]=0.84, 95% CI 0.60–1.17). Paramedics in the PASTA group took an average of 13.4 min longer to clear a care episode.

After completing a brief screen tool to confirm signs and symptoms of a stroke, using an instrument such as FAST[35] or the Cincinnati Prehospital Stroke Scale,[36] EMS personnel should then conduct a subsequent screen to identify potential patients with large vessel occlusions (LVOs) in the anterior circulation who may be potential candidates for EVT. While several validated scales are currently available, most of which are derived from 3–6 components of the National Institutes of Health Stroke Scale (NIHSS), the sensitivities and specificities of these scales are not ideal[37] and most have not been externally validated in the field.

Section 4: Emergency Department Evaluation

Standard assessments for patients with suspected acute stroke presenting to the ED include a rapid neurological examination and urgent brain and vascular imaging, followed by monitoring of vital signs, blood work, cardiovascular investigations, blood pressure management, glucose control, dysphagia screening, and seizure assessment. Given that some acute stroke symptoms including fatigue, anxiety, and dizziness may overlap with other cardiovascular and general medical conditions,[38] it is important to identify patients who are experiencing stroke "mimics" and to avoid unnecessary and expensive investigations and inappropriate long-term prevention treatments. Patients presenting with stroke symptoms may ultimately be diagnosed with other conditions such as migraine headache, vertigo, metabolic disturbances, brain tumors, or presyncope/syncope.[39] The NIHSS can be used to quickly screen for stroke-specific symptoms. For all patients arriving to hospital with suspected stroke or TIA, immediate brain and vascular imaging is the highest priority investigation once any life-threatening issues with respiration and circulation have been ruled out or addressed. A non-contrast CT scan is considered to be the imaging standard and the most cost-effective method to be used initially to identify acute ischemic stroke and to rule out intracranial hemorrhage.[40] While MRI with DWIs may be more sensitive in detecting early changes associated with ischemia, especially in patients with small infarcts, this technology may be not immediately available in many centers.[41] In the year 2019/20, there were 288 MRI machines in 378 facilities across Canada, equating to an availability of 10 units per million population.[42] Combined multimodal vascular imaging is

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4. Emergency Department Evaluation and Management of Patients with Transient Ischemic Attack and Acute Stroke Recommendations 2022

4.1 Initial Emergency Department Evaluation

i. All patients presenting to an emergency department with suspected acute stroke should be immediately assessed and undergo investigations without delay to establish a diagnosis and determine eligibility for thrombolysis and/or endovascular thrombectomy (EVT) [Strong recommendation; High quality of evidence].

   a. Patients with suspected acute stroke should have a rapid initial evaluation for airway, breathing, and circulation [Strong recommendation; High quality of evidence].

   b. Patients with suspected stroke should be triaged as Canadian Triage Acuity Scale (CTAS) Level 2 in most cases and as CTAS Level 1 for patients with compromised airway, breathing, or cardiovascular function [Strong recommendation; Low quality of evidence].

ii. Patients with suspected acute stroke should have a ***rapid neurological examination*** to determine focal neurological deficits using a validated scale such as FAST (Face, Arm, Speech, Time) [Strong recommendation; Moderate quality of evidence]; and to assess for stroke severity using a validated screen [Strong recommendation; High quality of evidence].

   a. A standardized stroke scale such as the National Institutes of Health Stroke Scale (NIHSS) should be included in the initial assessment [Strong recommendation; High quality of evidence].

   b. Initial assessment should include consideration of time of stroke symptom onset, stroke mimics, development of a plan for further management, and establishment of goals for care [Strong recommendation; Low quality of evidence] *Refer to Section 2 Triage and Initial Diagnostic Evaluation of Transient Ischemic Attack and Non-Disabling Stroke for additional information.*

iii. Patients with suspected acute stroke should undergo an assessment of heart rate and rhythm, blood pressure, temperature, oxygen saturation, point-of-care glucose, and presence of seizure activity [Strong recommendation; High quality of evidence].

   a. **(NEW FOR 2022)** Use or non-use of anticoagulants, including the timing of the last dose taken, should be sought and recorded [Strong recommendation; Moderate quality of evidence].

iv. Acute blood work should be conducted as part of the initial evaluation [Strong recommendation; Moderate quality of evidence].

   a. Initial blood work should include electrolytes, random glucose, complete blood count (CBC), coagulation status (INR, aPTT), and creatinine [Strong recommendation; High quality of evidence]. *Refer to online Supplemental Materials Table 2A for additional information on recommended laboratory investigations for acute stroke and TIA.*

   Note: Initial blood work tests ***should not delay imaging or treatment decisions and treatment initiation*** *for intravenous thrombolysis and EVT.*

v. **Seizure assessment:** Seizure in the presence of suspected acute stroke is not a contraindication for reperfusion and could be treated using appropriate short-acting medications (e.g., lorazepam IV) if the seizures are not self-limited [Strong recommendation; High quality of evidence]. *Refer to Section 9 Inpatient Prevention and Management of Complications Following Stroke for additional information.*

Note: If initial brain imaging reveals a hemorrhagic stroke, refer to CSBPR Management of Intracerebral Hemorrhage[18] module for additional information.

4.2 Neurovascular (Brain and Vascular) Imaging

i. All patients with suspected acute stroke should undergo brain and vascular imaging computerized tomography (CT) or magnetic resonance imaging (MRI) [Strong recommendation; High quality of evidence].

   a. Vascular imaging should be performed from arch-to-vertex and include the extra- and intra-cranial circulation to determine eligibility for acute treatment [Strong recommendation; High quality of evidence].

   Note: Primary stroke centres should make all efforts to perform combined CT and CTA on patient arrival. The CT and CTA should be done at same time and not in separate visits to the imaging suite. Stroke centres that cannot do CTA should have pre-planned arrangements for rapid transfer of appropriate patients. They should complete ***non-contrast CT*** *(NCCT) and offer intravenous thrombolysis as appropriate and then rapidly transfer the patient to a comprehensive stroke centre for more advanced imaging and consideration for EVT. (Refer to IV thrombolysis Section 5 for additional information).*

ii. All patients with suspected acute ischemic stroke who arrive at hospital **within 6 hours** who are potentially eligible for intravenous thrombolysis and/or EVT should undergo *immediate* ***non-contrast CT (NCCT)*** **combined with CT angiography (CTA) of the head and neck,** performed and interpreted without delay [Strong recommendation; High quality of evidence]. *Refer to online Supplemental Materials for eligibility criteria in Boxes 4A, 4B, 5A, 5B, and 5C.*

iii. All patients with suspected ischemic stroke due to large vessel occlusion (LVO) **arriving 6 to 24 hours** after stroke symptom onset (including stroke on awakening or with unknown onset time) and who are potentially eligible for late window EVT should undergo immediate brain imaging with NCCT with CTA and CT perfusion (CTP); or magnetic resonance imaging (MRI) with MR angiography (MRA) and MR perfusion (MRP) [Strong recommendation; High quality of evidence]; or CT with multiphase CTA [Strong recommendation; Moderate quality of evidence]. *Refer to Section 4.1 for criteria regarding screening with use of validated screening tools. Refer to online Supplemental Materials Box 4C for additional information.*

iv. A validated triage tool, such as ASPECTS, should be used to rapidly identify patients who may be eligible for EVT and who may require transfer to a different facility for EVT [Strong recommendation; Moderate quality of evidence].

v. Advanced CT imaging such as CT perfusion (CTP) or multiphase CTA to assess pial collateral vessels is strongly encouraged as part of initial imaging to aid patient selection for EVT [Strong recommendation; Moderate quality of evidence]. However, advanced imaging must not substantially delay decision-making and treatment with intravenous thrombolysis or EVT. *Refer to online Supplemental Materials Boxes 4A, 4B, 4C, 5A, 5B, and 5C for additional information.*

Note: If there are signs of hemorrhage on initial CT images there is no need to proceed to CTP imaging as part of initial imaging and CTA should be completed based on the clinical judgement of the treating physician.

Note: In most Canadian centres a CT approach may be more practical and more readily available than an MR approach. Choice of imaging modality should be based on most immediate availability and local resources.

Refer to Section 5 Acute Ischemic Stroke Treatment for information on administration of intravenous thrombolysis and EVT.

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4. Emergency Department Evaluation and Management of Patients with Transient Ischemic Attack and Acute Stroke Recommendations 2022

Section 4.2 Clinical Considerations

1. MRI as a first line for imaging can be challenging to obtain urgently in an emergency department setting. Obtaining an MRI scan should not delay decision-making regarding intravenous thrombolysis and EVT eligibility.
2. Patients with a known allergy to contrast dye or with existing renal failure should not be excluded from consideration for EVT.

4.3 Acute Blood Pressure Management

i. **Patients with ischemic stroke eligible for thrombolytic therapy**: Blood pressure should be lowered and sustained below 185/110 while initiating and during IV thrombolysis therapy, and for the next 24 hours for ischemic stroke patients who are eligible for thrombolytic therapy [Strong recommendation; Low quality of evidence].

ii. **Patients with ischemic stroke not eligible for thrombolytic therapy**: Patients with moderate blood pressure elevation (up to 220 mmHg systolic) should not be routinely treated if they are not eligible for thrombolytic therapy [*Conditional recommendation*; Low quality of evidence].

   a. Patients with extreme blood pressure elevation (e.g., systolic BP >220 or diastolic BP >120 mmHg) should be considered for blood pressure lowering therapy if they are not eligible for thrombolytic therapy [*Conditional recommendation*; Low quality of evidence].

iii. Rapid or excessive lowering of blood pressure should be avoided as this might exacerbate existing ischemia or might induce ischemia, particularly in the setting of intracranial or extracranial arterial occlusion [*Conditional recommendation*; Low quality of evidence].

   a. Reducing the blood pressure by approximately 15% and not >25% over the first 24 hours, with further gradual reduction thereafter to targets for long-term secondary stroke prevention, may be considered [*Conditional recommendation*; Low quality of evidence].

Note: Refer to CSBPR Management of Intracerebral Hemorrhage module[18] for information on blood pressure management of hemorrhagic stroke.

Section 4.3 Clinical Considerations

1. The choice of agents to manage blood pressure should be based on current Hypertension Canada blood pressure treatment guidelines. *Refer to www.hypertension.ca.*

4.4 Cardiovascular Investigations

i. Patients with acute ischemic stroke or TIA should have a 12-lead ECG to assess cardiac rhythm and identify atrial fibrillation or flutter or evidence of structural heart disease (e.g., myocardial infarction and left ventricular hypertrophy) [Strong recommendation; Moderate quality of evidence].

ii. Unless a patient is hemodynamically unstable, ECG should not delay assessment for intravenous thrombolysis and EVT and can be deferred until after a decision regarding acute treatment is made [Strong recommendation; Moderate quality of evidence].

Note: For patients being investigated for an acute embolic ischemic stroke or TIA of undetermined source whose initial short-term ECG monitoring does not reveal atrial fibrillation but a cardioembolic mechanism is suspected, refer to CSBPR Secondary Prevention of Stroke module, Section 7 *for additional information.*

Refer to CSBPR Secondary Prevention of Stroke module[13] for additional information on echocardiography and rhythm monitoring.

4.5 Blood Glucose Abnormalities

i. All patients with suspected acute stroke should have their blood glucose concentration checked on arrival to the emergency department (*or review glucose provided by EMS for any immediate management required)* [Strong recommendation; Moderate quality of evidence].
Refer to online Supplemental Materials Table 2A Recommended Laboratory Investigations for Patients with Acute Stroke or Transient Ischemic Attack for additional information. Refer to Section 3 Emergency Medical Services Management of Acute Stroke for additional information on EMS management.

ii. Hypoglycemia should be corrected immediately using local protocols [Strong recommendation; High quality of evidence].

iii. Although no optimal glucose target has been identified in the acute stage, it may be reasonable to treat hyperglycemia (glucose >20 um/l) as per local protocols as this has been associated with increased risk of hemorrhagic transformation when treating with intravenous thrombolysis [*Conditional recommendation*; Low quality of evidence].

4.6 Additional Management Considerations in the Emergency Department

i. **Chest X-ray:** A routine chest x-ray is not required for acute stroke; chest x-ray should be considered if there is concern for acute cardio-pulmonary disease [Strong recommendation; Low quality of evidence]; otherwise, this should not delay the CT scan and decisions regarding reperfusion [Strong Recommendation; Moderate Quality of evidence].

ii. **Swallowing assessment**: All patients with acute stroke or TIA should have a swallowing screen completed as soon as possible as part of initial assessment by a practitioner trained to use a validated swallowing screening tool; however, screening should not delay decision-making regarding eligibility for reperfusion treatments [Strong recommendation; High quality of evidence].

   a. Ideally swallowing screens should be done within 24 hours of hospital arrival, including for patients that receive acute stroke treatments such as intravenous thrombolysis and EVT [Strong recommendation; Moderate quality of evidence].

   b. Patients should remain NPO (*nil per os* [no oral intake]) until a swallowing screen is completed, for patient safety [Strong recommendation; High quality of evidence].

   c. Oral medications should not be administered until a swallowing screen using a validated tool has been completed and found to be normal [Strong recommendation; Moderate quality of evidence]; alternate routes such as intravenous and rectal administration should be considered while a patient is NPO.

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4. Emergency Department Evaluation and Management of Patients with Transient Ischemic Attack and Acute Stroke Recommendations 2022

d. A patient's clinical status can change in the first hours following a stroke or TIA; therefore, patients should be closely monitored for changes in swallowing ability following initial screening [Strong recommendation; Low quality of evidence].

e. Patients found to have abnormal swallowing ability on screening should remain NPO and be referred to a healthcare professional with expertise in this area for further swallowing assessment [Strong recommendation; Moderate quality of evidence].

Note: *Swallow assessments are particularly important for patients discharged to the community directly from the emergency department or repatriated to a lower level of care.*

Refer to Section 9 Inpatient Prevention and Management of Complications Following Stroke, and CSBPR Rehabilitation and Recovery following Stroke module,[29] Section 7 for additional information on screening for swallowing ability and dysphagia management.

iii. **Urethral catheters:** The use of indwelling urethral catheters should generally be avoided due to the risk of urinary tract infections [Strong recommendation; Moderate quality of evidence]. *Refer to Section 9 Inpatient Prevention and Management of Complications Following Stroke for additional information.*

a. Insertion of an indwelling urethral catheter should be considered for patients undergoing EVT when necessary, but this should not delay beginning the procedure. The need to retain the catheter should be reconsidered after the end of the EVT procedure, and the use of the catheter should be discontinued as soon as the patient is able to resume voiding on their own [*Conditional recommendation*; Low quality of evidence].

b. Insertion of an indwelling urethral catheter is not routinely needed prior to intravenous thrombolysis unless the patient is acutely retaining urine and is unable to void. If inserted for patient-specific reasons, it should not delay acute treatment [Strong recommendation; Moderate quality of evidence].

c. If used, indwelling catheters should be reassessed daily and removed as soon as possible [Strong recommendation; High quality of evidence].

d. Fluid status and urinary retention should be included as part of routine monitoring of vital sign assessments [Strong recommendation; Moderate quality of evidence].

iv. **Temperature:** Temperature should be routinely monitored and treated per local protocols [Strong recommendation; Moderate quality of evidence]. *Refer to Section 9 Inpatient Prevention and Management of Complications Following Stroke for additional information.*

v. **Oxygen:** Supplemental oxygen is not required for patients with normal oxygen saturation levels [Strong recommendation; Moderate quality of evidence].

4.7 Virtual Acute Stroke Care (Telestroke)

Note: The recommendations in n Section 4.7 are mainly aimed at Level 3, 4, and 5 stroke centres (based on CSBPR categories; Refer to online Supplemental Materials Figure 2, Acute Stroke Service Capability). Patients with suspected acute stroke presenting to a Level 1 or 2 hospital that does not have acute stroke capability should be immediately transferred to the closest Level 3, 4, or 5 stroke centre per local bypass protocols and agreements.

i. Virtual acute stroke care delivery modalities should be integrated into stroke care planning and service delivery to ensure equitable access to care across geographic regions in Canada [Strong recommendation; Moderate quality of evidence].

4.7.1 Organization of Virtual Healthcare Services for Acute Stroke Management

i. Virtual acute stroke care networks should be in place and readily available when stroke expertise is not available on-site, to allow access to consultations with stroke experts for acute stroke assessment, diagnosis, and treatment, including acute thrombolytic therapy and decision-making for EVT [Strong recommendation; Moderate quality of evidence].

ii. Consulting and referring sites should have standardized protocols and processes in place to ensure access to stroke experts through virtual healthcare modalities, available 24 hours a day, seven days a week to provide equitable access to time-driven advanced stroke care across Canada [Strong recommendation; Moderate quality of evidence].

iii. The consultant should be a physician with specialized training in acute stroke management and must have timely access to diagnostic-quality neurovascular (e.g., brain CT, CTA) images during the virtual acute stroke consultation [Strong recommendation; High quality of evidence]. *Refer to CSBPR Virtual Stroke Care Implementation Toolkit for additional information at www.strokebestpractices.ca.*

Note: The decision to use acute stroke therapies in emergency management requires imaging to rule out hemorrhage. Refer to Sections 4, 5, and 6 in this document for additional information on imaging and revascularization.

iv. Real-time two-way audiovisual communication should be in place to enable remote clinical assessment of the patient by the consulting stroke expert [Strong recommendation; Moderate quality of evidence].

a. Virtual acute stroke modalities including video-conferencing and teleradiology systems may be considered to support screening and decision-making regarding candidacy for thrombolysis and/or EVT in appropriate cases and to facilitate transfer to endovascular-enabled stroke centres [Strong recommendation; Moderate quality of evidence].

b. The benefits of telephone consultation without video are not well-established and every attempt should be made to connect via a video link [Conditional recommendation; Low quality of evidence].

v. All laboratory and diagnostic results required by the consultant should be made readily available during the virtual acute stroke care consultation [Strong recommendation; Moderate quality of evidence].

vi. Referring physicians should follow an established protocol or algorithm that describes the critical steps and inclusion/exclusion criteria for thrombolysis and/or recanalization therapies, which are agreed to by both the referring and consulting sites [Strong recommendation; High quality of evidence]. *Refer to Section 3 Emergency Medical Services Management of Acute Stroke for additional information.*

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4. Emergency Department Evaluation and Management of Patients with Transient Ischemic Attack and Acute Stroke Recommendations 2022

vii. Referring physicians and nursing staff who may be involved in virtual acute stroke consultations should ideally be trained in administration of the NIHSS, so they can assist the telestroke consultant efficiently and competently during the remote video neurological examination [Strong recommendation; Moderate quality of evidence].

viii. The most responsible physician remains the attending physician at the referring site. Decision-making is a consensus process that is achieved in consultation with the attending medical staff at the referring site, the patient and family, and the consulting physician with stroke expertise [Strong recommendation; Low quality of evidence].

ix. A consulting physician with stroke expertise should remain accessible as they may be required to provide ongoing guidance to the referring site following initial consultation [Strong recommendation; Low quality of evidence].

x. Protocols should be in place that define patient transfer criteria to a more advanced stroke care facility when clinically indicated (e.g., for endovascular [if available], neurosurgical intervention) [Strong recommendation; Low quality of evidence].

   a. The virtual acute stroke care system should identify the stroke centres that are able to provide endovascular and neurosurgical care [Strong recommendation; Low quality of evidence].

   b. For patients who are deemed eligible for endovascular treatment or neurosurgical interventions, protocols should be in place to define the process for patient transfer [Strong recommendation; Moderate quality of evidence]. *Refer to Section 6 Acute Antithrombotic Therapy for additional information.*

xi. The use of standardized documentation should be considered for both the referring site and the consulting site, in accordance with hospital processes, jurisdictional legislation, and regulatory bodies [Strong recommendation; Low quality of evidence]. This may include:

   a. A consultation note provided by the consulting physician to the referring site at the end of the consultation, to be included in the patient medical record [Strong recommendation; Low quality of evidence].

   b. A discharge summary sent by the referring site to the consulting virtual acute stroke physician to provide feedback about the patient's outcome [Strong recommendation; Low quality of evidence].

   c. For patients who are transferred to another hospital (e.g., "drip and ship"), a discharge summary from the receiving hospital to the referring physician and the virtual acute stroke physician [Strong recommendation; Low quality of evidence].

xii. Processes should be in place to ensure timely and effective transfer of up-to-date, relevant information in the patient medical record (e.g., patient progress, treatment plans, plans for ongoing follow-up, discharge recommendations) from the consulting healthcare provider to the referring site, in accordance with clinical care processes, organizational requirements, jurisdictional legislation, and regulatory requirements [Strong recommendation; Low quality of evidence]. *Refer to CSBPR Transitions and Community Participation Following Stroke Section 3.3 for additional information.*[43]

xiii. Data related to the virtual acute stroke consultation and outcome should ideally be collected by the virtual acute stroke program for continuing quality improvement [Strong recommendation; Low quality of evidence].

4.7.2 **Staff Training and Ongoing Education**

i. Consulting physicians and other healthcare professionals involved in virtual acute stroke consults should have expertise and experience in managing patients with stroke [Strong recommendation; Low quality of evidence].

ii. It is recommended that virtual acute stroke care providers attain and maintain the necessary competencies required to provide safe, competent virtual care and to create a satisfactory telehealth encounter for both the patient and the healthcare provider [Strong recommendation; Low quality of evidence].

iii. Referring and consulting service providers should be trained to use the virtual acute stroke system and should understand their roles and responsibilities for the technical and clinical aspects of an acute virtual stroke care consultation [Strong recommendation; Low quality of evidence].

iv. Virtual stroke care training should include physicians, nurses, therapists, and any support staff (e,g., members of technology department) who may be involved in any virtual acute stroke consultation or therapy appointment [Strong recommendation; Low quality of evidence].

v. Ongoing virtual acute stroke training and education with a regular update cycle is useful to ensure competency of providers [Strong recommendation; Low quality of evidence]. *Refer to CSBPR Virtual Stroke Care Implementation Toolkit for additional information and resources for staff training, at www.strokebestpractices.ca.*

vi. Continuing education in online and face-to-face formats is useful to ensure remote-based practitioners have access to ongoing education [Strong recommendation; Low quality of evidence].

Section 4.7 Clinical Considerations

1. Mock acute stroke patient scenarios and practice cases may be helpful, especially for acute/emergent virtual stroke care at new sites, and where the ongoing volume of cases is low.

2. Routine checks of acute virtual stroke care equipment (both video-conferencing and imaging systems such as PACS) should be done to ensure the equipment will function properly in an emergency. This may be done as part of routine checks on other emergency equipment such as crash carts. Some systems may have a back-up system or alarms for malfunctioning equipment.

3. Where electronic health records are available, health information sharing regulations that comply with provincial and federal privacy legislation should be developed, to allow an individual patient's record to be shared with referring and consulting facilities.

4. Efforts should be made to design telestroke technology, so it is easy to use and operate, to facilitate adoption of the technology and decrease the time needed to meet educational requirements.

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4. Emergency Department Evaluation and Management of Patients with Transient Ischemic Attack and Acute Stroke Recommendations 2022

Box 4B Imaging Criteria for Consideration of Endovascular Thrombectomy in Patients Arriving Within 6 Hours of Stroke Onset

4B.1. For anterior circulation: Imaging Criteria for Endovascular Thrombectomy in Patients Arriving Within 6 Hours of Stroke Onset

1. Presence of an intracranial artery occlusion in the anterior circulation on CTA or MRA, including occlusion of the terminal internal carotid artery or proximal MCA

AND

2. Presence of a small to moderate ischemic core on non-contrast CT or MRI, usually consistent with an ASPECTS score of ≥6 for the anterior circulation.

   a. Patients presenting with an intracranial artery occlusion and large core, such as those with an ASPECT score <6, may be considered for EVT based on expected risks and benefits, after consultation with a physician with stroke expertise and with the treating neurointerventionalist, along with the patient and/or family and/or substitute decision-makers.

4B.2 For posterior circulation: Imaging Criteria for Consideration of Endovascular Thrombectomy for Patients Arriving Within 6 Hours of Stroke Onset

1. Patients presenting with an intracranial occlusion of the posterior circulation (e.g., the basilar artery) may be considered for EVT based on expected risks and benefits, after consultation with a physician with stroke expertise and with the treating neurointerventionalist, along with the patient and family or substitute decision-maker.
   Note: Randomized trials are ongoing, and this recommendation will be reviewed once the results become available.

Refer to online Supplemental Materials for additional information.

extremely important, and in highly selected cases, perfusion scans with CT or MRI has the potential to identify patients with an ischemic penumbra and potentially viable brain tissue who may be appropriate for acute reperfusion therapies. Perfusion scans can be especially useful in selecting patient eligible for endovascular therapy in the 6-to-24-h window whereas in the 0-to-6-h time frame, and most cases can be selected with the use of CT and CTA alone.

Section 5: Acute Ischemic Stroke Treatment

While the weight of evidence clearly indicates that treatment with intravenous alteplase, administered within 4.5 h of symptom onset, improves functional outcomes and reduces the risks of death or disability,[44,45] there are limited data on the benefit of treatment beyond this window. The most recent trials of thrombolytic therapy in the extended time window include EXTEND[46] and WAKE-UP,[47] in which patients presenting with symptoms beyond 4.5 h or with unknown time of onset were selected for treatment on the basis of advanced imaging. In both trials, patients receiving alteplase were more likely to achieve an excellent outcome (mRS 0–1) at 90 days, relative increase 44%[46]% and 61%,[47] symptomatic ICH and death were higher in the intervention group.

The results from several recent trials indicate that tenecteplase, a newer thrombolytic agent that has pharmacokinetic advantages over alteplase, is non-inferior to alteplase. Among the completed trials to date, the AcT trial[48] was the first to report that tenecteplase at a dose of 0.25 mg/kg (maximum 25 mg) is non-inferior to standard dose alteplase. At 90 days, 36.9% of patients in the tenecteplase group achieved the primary outcome (mRS score of 0–1) versus 34.8% in the alteplase group (unadjusted difference = 2.1%, 95% CI -2.6% to 6.9%; adjusted relative risk [RR] = 1·1, 95% CI 1·0 to 1·2), meeting the non-inferiority threshold (the lower bound 95% CI of which was set at greater than -5%). There was no significant difference between groups in terms of mortality at 90 days (15.3% vs. 15.4%), or in the proportion with symptomatic ICH at 24 h (3.4% vs. 3.2%). In contrast to these findings, the NOR-TEST 2[49] trial of alteplase versus tenecteplase 0.4 mg/kg was halted early due to safety concerns, which included an increased risk of intracranial hemorrhage and mortality; however, the dose in the tenecteplase group was higher (0.4 mg/kg) than is currently recommended (0.25 mg/kg). In the EXTEND-IA TNK,[50] where patients with LVO received treatment with both thrombolysis and EVT, a significantly higher number of patients receiving tenecteplase 0.25 mg/kg achieved substantial reperfusion (22% vs. 10%, p = 0.02 for superiority), although the percentage of patients who were functionally independent at 90 days or who had achieved an excellent outcome did not differ between groups. Several clinical trials comparing tenecteplase with alteplase (ATTEST2 NCT0281440) and tenecteplase with placebo, or best medical management (TIMELESS NCT03785678, TWIST NCT0318 1360, and TEMPO-2 NCT02398656) are ongoing.

A 2021 Cochrane review[51] that included the results of 19 trials adds to the growing body of evidence indicating that EVT performed within 6 h of symptom onset is an extremely effective treatment for patients with LVO in the anterior circulation. Treatment with EVT was associated with a significantly higher likelihood of favorable outcome (RR = 1.61, 95% CI 1.42 to 1.82) with a high certainty of evidence, without a significantly increased risk of symptomatic intracranial hemorrhage (RR = 1.46, 95% CI 0.91 to 2.36) compared with usual care, which in many cases included the use of alteplase. For selected patients, the treatment window for EVT may be even longer. A pooled analysis of six randomized controlled trials[52] including patients who received treatment between 6 and 24 h after the onset of symptoms also found significantly better outcomes in patients in the intervention group. There was a significant shift in the ordinal analysis of mRS scores favoring less disability in the thrombectomy group (adjusted OR =2·54, 95% CI 1·83–3·54). The odds of achieving an mRS score of 0–1 or 0–2 at 90 days were both significantly higher in the EVT group (adjusted OR = 2·41, 95% CI 1·07–5·43 and adjusted OR = 3·88, 95% CI 1·94–7·78, respectively). The number needed to treat for one more patient to be independent with EVT was 2.6.

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5. Acute Ischemic Stroke Treatment Recommendations 2022

5.1 Patient Selection for Acute Ischemic Stroke Treatments

i. **Within 6 hours of stroke symptom onset:** All patients with ***disabling*** acute ischemic stroke who can be treated within the indicated time windows must be screened ***without delay*** by a physician with stroke expertise (either on-site or by virtual acute stroke care/telestroke consultation) to determine their eligibility for both intravenous thrombolysis and/or interventional treatment with EVT within a 6-hour window from stroke symptom onset or last known well time) [Strong recommendation; High quality of evidence].

   a. When it is unclear if a patient should be treated with IV thrombolysis, urgent consultation with a stroke specialist on-site or through virtual stroke services is recommended [Strong recommendation; Low quality of evidence]

   b. If there is uncertainty about interpretation of CT imaging, urgent consultation with a radiologist either on-site or through virtual telestroke services is recommended [Strong recommendation; Low quality of evidence].

ii. **Beyond 6 hours of stroke symptom onset or last known well:** All patients with disabling acute ischemic stroke who are between 6 and 24 hours of stroke symptom onset or last known well should be rapidly screened to determine eligibility for urgent advanced neurovascular imaging and acute stroke treatments [Strong recommendation; Moderate quality of evidence]. *Refer to online Supplemental Materials Box 5A for a summary of treatment time windows.*

Section 5.1 Clinical Considerations

1. Intravenous thrombolysis beyond 4.5 hours may be considered, in consultation with a physician with stroke expertise and based on advanced imaging.
2. If a large vessel occlusion (LVO) is present, consideration for thrombolysis beyond 4.5 hours from the time the patient was last known well should not delay decisions regarding EVT.

5.2 (REVISED FOR 2022) Intravenous Thrombolysis Administration

i. All eligible patients with disabling ischemic stroke, who can receive intravenous thrombolysis with either alteplase or tenecteplase within 4.5 hours of stroke symptom onset time or last known well time should be offered intravenous thrombolysis [Strong recommendation; High quality of evidence]

   Refer to online Supplemental Materials Box 4A for detailed recommendations on neuroimaging. Refer to online Supplemental Materials Box 5A for time windows, Box 5B for inclusion and exclusion criteria for intravenous thrombolysis eligibility. Refer to Section 5.1 Clinical Considerations for information about patients who arrive beyond the 4.5-hour time window.

ii. All eligible patients should receive intravenous thrombolysis ***as soon as possible*** after hospital arrival [Strong recommendation; High quality of evidence], with a target median door-to-needle time of <= 30 minutes and a door-to-needle time of <= 60 minutes in at least 90% of treated patients [Strong recommendation; Moderate quality of evidence]

   a. Treatment should be initiated as soon as possible after patient arrival and CT scan completion [Strong recommendation; High quality of evidence].

   b. Every effort should be made to ensure door-to-needle times are routinely monitored and improved [Strong recommendation; Moderate quality of evidence].

iii. **Alteplase dose:** If using alteplase, the dose of 0.9 mg/kg to a maximum of 90 mg total dose should be administered, with 10% (0.09 mg/kg) given as an intravenous bolus over one minute and the remaining 90% (0.81 mg/kg) given as an intravenous infusion over 60 minutes [Strong recommendation; High quality of evidence].

iv. (NEW FOR 2022) **Tenecteplase** may be considered as an alternative to alteplase within 4.5 hours of acute stroke symptom onset [Strong recommendation; Moderate quality of evidence].

   a. **Tenecteplase dose**: If administering Tenecteplase, the dose of 0.25 mg/kg up to a maximum of 25 mg should be administered, given as a single bolus over 5 seconds [Strong recommendation; Moderate quality of evidence].

   Caution: The dosing of alteplase and tenecteplase for stroke is NOT the same as the dose protocols for administration of these medications for myocardial infarction or massive pulmonary embolism.

v. Individuals receiving IV thrombolysis should be closely monitored for the first 24 hours for complications from IV thrombolysis administration:

   a. For patients with sudden deterioration during or following administration of IV thrombolysis, an emergent CT scan should be done [Strong recommendation; Moderate quality of evidence].

   b. For patients with orolingual angio-edema:

      1. IV thrombolysis should be discontinued if still infusing at the first signs of angioedema [Strong recommendation; Moderate quality of evidence].

      2. The following medications are recommended: antihistamines (H1 blocker [e.g., diphenhydramine], H2 blocker [e.g., famotidine]). Consider glucocorticoids inhaled racemic epinephrine as part of standard airway management [Strong recommendation; Low quality of evidence].

   For patients with symptomatic ICH following IV thrombolysis refer to section 5.6.

   c. **Systemic hemorrhage**: For patients with spontaneous systemic hemorrhage at a non-compressible site (e.g., gastrointestinal hemorrhage, oral hemorrhage), IV thrombolysis should be discontinued, consideration should be given to lowering blood pressure, and hemostatic management should be considered [Strong recommendation; Low quality of evidence].

      1. Consultation with appropriate specialists should be undertaken to aid in achieving hemostasis [Strong recommendation; Low quality of evidence].

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5. Acute Ischemic Stroke Treatment Recommendations 2022

Section 5.2 Clinical Considerations

1. **Consent:** Intravenous thrombolysis and EVT are considered the standard of care for acute stroke treatment. Routine procedures for emergency consent apply.
2. **Intravenous thrombolytic administration for patients on Direct oral anticoagulants (DOACs)**: Intravenous thrombolytics should ***not*** routinely be administered to patients on DOACs who present with acute ischemic stroke. In comprehensive stroke centres with access to specialized tests of DOAC levels and reversal agents, thrombolysis could be considered, and decisions should be based on individual patient characteristics, in consultation with thrombosis specialists, patients, and their families.
    a. The benefits and risks of providing intravenous thrombolysis to a patient who is being treated with the combination of antiplatelet and low-dose DOAC (i.e., COMPASS trial protocol) are unclear. Treatment may be considered in consultation with a stroke expert.
    b. Anticoagulation is not a contraindication for EVT, and the decision to treat should be based on individual patient factors and assessment of benefit and risk.
    c. Patients who present with stroke who are taking a DOAC may be considered for rapid reversal if otherwise eligible for IV thrombolysis and if a reversal agent is readily available. Consultation with an expert in stroke care in strongly advised for these cases.
3. The use of epinephrine in angioedema or refractory hypotension should be reserved for life-threatening emergencies due to increased risk of hypertension post-medication administration.
4. There are some situations where clinical trial data to support the use of intravenous thrombolytic therapy is more limited. In these situations, urgent consultation with a stroke expert is recommended along with the clinical judgment of the treating physician and discussion with the patient or substitute decision-makers.
    a. For example, this may apply to pediatric patients with stroke (newborn to age 18 years); and pregnant women who experience an acute ischemic stroke. *Refer to Canadian Stroke Best Practices Management of Acute Stroke During Pregnancy Consensus Statement for additional information.*[53]
5. (NEW FOR 2022) Evidence for the use of intravenous thrombolysis and EVT is derived from randomized trials that enrolled patients who were functionally independent at baseline. The use of intravenous thrombolysis and/or EVT in patients who are ***not functionally independent*** may be considered, based on careful review of risks and benefits for the patient. The patient's goals of care should be discussed in consultation with a physician with stroke expertise, and/or a neurointerventionalist, and the patient and/or family and/or substitute decision-makers.
6. (NEW FOR 2022) **Hypertension with symptomatic ICH**: In patients with symptomatic ICH who are hypertensive (>185/110 mm HG), blood pressure should be lowered, however, the specific target and duration of therapy are unknown at this time.

5.3 Stroke While Already in Hospital

i. **Patients already admitted to hospital*** who present with a sudden onset of new stroke symptoms should be rapidly evaluated without delay for eligibility for acute stroke treatment and provided with access to appropriate acute stroke treatments (including IV thrombolysis and EVT) [Strong recommendation; Moderate quality of evidence].

Note: When an inpatient has a stroke while in hospital, all other sections of the CSBP modules apply to these patients for assessment, diagnosis, management, and recovery.

** "Admitted to hospital" is defined as any person admitted to an emergency department, inpatient unit, or outpatient clinic or rehabilitation service in a hospital setting.*

5.4 Endovascular Thrombectomy for Acute Ischemic Stroke

Refer to Section 4.2 and to online Supplemental Materials Boxes 4A, 4B, and 4C for detailed recommendations on neuroimaging-based selection criteria.

i. Endovascular Thrombectomy (EVT) should be offered within a coordinated system of care including coordination among emergency medical services, access to rapid neurovascular (brain and vascular) imaging, the emergency department, the stroke team and radiology, local experts in neuro intervention, anesthesia, and access to a stroke unit for ongoing management [Strong recommendation; High quality of evidence].

ii. EVT is indicated in patients based on imaging selection, most commonly performed with non-contrast CT head and CT angiography (including extracranial and intracranial arteries) [Strong recommendation; High quality of evidence]. *Refer to online Supplemental Materials Box 5C for inclusion criteria for EVT.*

iii. EVT may be indicated in patients with proximal anterior circulation occlusions who have received intravenous thrombolysis, as well as those who are not eligible for intravenous thrombolysis [Strong recommendation; High quality of evidence].

iv. Intravenous thrombolysis should be provided to all eligible patients, including those patients who are also eligible for EVT [Strong recommendation; High quality of evidence].
    a. For patients who are also eligible for intravenous thrombolysis, this should be initiated while simultaneously preparing the angiography suite for EVT [Strong recommendation; High quality of evidence]. Treatment with either intravenous thrombolysis or EVT should not be delayed for any reason.

5.4.1 Anterior Circulation

v. For large artery occlusions in the anterior circulation, EVT should be considered based on patient pre-morbid function, clinical deficit, and imaging findings. Patients who can be treated **within 6 hours** of symptom onset (i.e., arterial access within 6 hours of last known well time) should receive EVT [Strong recommendation; High quality of evidence]. *Refer to online Supplemental Materials Box 4B for Imaging Inclusion Criteria for endovascular thrombectomy.*

vi. ***Selected patients*** with LVO and who are eligible based on premorbid status and advanced neuroimaging, should be treated with EVT **within 24 hours** of last known well time (i.e., arterial access within 24 hours of last known well time) [Strong recommendation; High quality of evidence]. *Refer to online Supplemental Materials Box 4C for imaging inclusion criteria for EVT beyond 6 hours from stroke symptom onset.*

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5. Acute Ischemic Stroke Treatment Recommendations 2022

5.4.2 Posterior Circulation

vii. For large artery occlusions in the posterior circulation (e.g., basilar artery occlusion) EVT should be considered based on patient pre-morbid function, clinical deficit, and imaging findings. Consultation with a physician with stroke expertise and with the patient and/or substitute decision-makers is recommended [Conditional recommendation; Moderate quality of evidence]. *Note: Randomized trials are ongoing, and this guidance will be reviewed when trial results are available.*

5.4.3 Sedation for Endovascular Interventions

viii. For endovascular interventions, procedural sedation is generally preferred over intubation and general anesthesia in most patients [Strong recommendation; Moderate quality of evidence]

ix. General anesthesia is appropriate if medically indicated (e.g., for airway compromise, respiratory distress, depressed level of consciousness, severe agitation, or other indication potentially impairing the technical ability to perform the procedure, as determined by the treating physician). General anesthesia may also be considered if technical complexity is expected during the stroke intervention. In such cases, excessive and prolonged hypotension and time delays should be avoided [Strong recommendation; Moderate quality of evidence].

Section 5.4 Clinical Considerations

1. For patients transferred to an EVT-enabled hospital, repeat neuroimaging immediately on arrival, to confirm eligibility, may be considered. The decision to repeat may be based on multiple factors: initial imaging features (including quality), clinical presentation, adjuvant medical therapies, changes in health status, and delay in arrival to the EVT-enabled site. Repeat imaging may include part or all of the neuroimaging recommended in Section 4.2.
2. Device selection should be at the discretion of the interventionalists based on clinical and technical factors during the procedure.
3. There should be a process at EVT centres to activate anesthesia without delay when deemed necessary.
4. Patients with stroke discovered on awakening or with unknown last known well time should be considered for EVT if eligible based on imaging findings and clinical presentation. *Refer to online Supplemental Materials Box 5C for more information.*
5. For patients undergoing EVT following administration of thrombolysis, there should not be a delay in proceeding to EVT to determine clinical effectiveness of thrombolysis.
6. (NEW FOR 2022) When a patient who is eligible for *both* intravenous thrombolysis and EVT presents DIRECTLY TO AN EVT-CAPABLE HOSPITAL, a decision *not* to administer intravenous thrombolysis and proceed straight to EVT must balance both the patient-related and operational factors in play at that moment, for that patient. The overarching focus is to improve patient outcomes while safely reducing door-to-needle and door-to-puncture times. The main driver for an excellent outcome remains "time is brain".

   Note: Clinical consideration 6 is controversial. It will be updated as additional evidence becomes available. In the meantime, clinicians involved in acute stroke care should focus on improving patient outcomes while safely reducing door-to-needle and door-to-puncture times. The main driver for excellent outcomes remains "time is brain".

5.5 Seizure Management

i. Seizure in the presence of suspected acute stroke is not a contraindication for revascularization and could be treated using appropriate short-acting medications (e.g., lorazepam IV) if the seizures are not self-limited [Conditional recommendation; Low quality of evidence].

5.6 (NEW FOR 2022) Emergency Management of Thrombolysis-Associated Hemorrhage

Note: Section *5.6 applies to patients experiencing a cerebral or systemic hemorrhage following administration of intravenous thrombolysis. Refer to CSBPR guidelines on Management of Intracerebral Hemorrhage for additional information.*[18]

5.6.1 Intracranial Hemorrhage

i. Intracranial hemorrhage should be considered if there is a change in neurological symptoms or signs, especially a reduction in level of consciousness, or a spike in blood pressure with persisting blood pressure elevation, or new or worsened headache [Strong recommendation; Moderate quality of evidence].

ii. An immediate non-contrast CT head should be done to assess for intracranial hemorrhage [Strong recommendation; Moderate quality of evidence].

iii. The patient should be accompanied to the CT by a member of the stroke team and the results reviewed immediately. If there is no intracranial hemorrhage, CTA should be urgently considered to identify intracranial occlusion and the need for urgent EVT should be considered [Strong recommendation; Moderate quality of evidence].

iv. If intracranial hemorrhage is identified, the intravenous thrombolysis infusion should be discontinued immediately if it is still running [Strong recommendation; Moderate quality of evidence].

v. If intracranial hemorrhage is identified, blood work, including a complete blood count (CBC) and INR (PT), as well as type and cross, should be drawn [Strong recommendation; Moderate quality of evidence], with STAT results requested [Strong recommendation; Low quality of evidence].

vi. The following agents may be considered, as they have shown potential benefit and limited harm: cryoprecipitate, human fibrinogen concentrate fresh frozen plasma, tranexamic acid. Use of these medications should be considered on an individual, case-by-case basis [Conditional recommendation; Low quality of evidence].

vii. The following treatment options should probably be avoided as they have ***not*** shown benefit and have shown potential for harm: prothrombin complex concentrates, platelet transfusions, factor VIIa [Conditional recommendation; Low quality of evidence].

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5. Acute Ischemic Stroke Treatment Recommendations 2022

5.6.2 Extracranial (Systemic) Hemorrhage Management

Note: For systemic hemorrhage, follow local protocol for management guidance.

i. A diagnosis of systemic bleeding should be considered when the following are present or suspected [Strong recommendation; Moderate quality of evidence]:
   a. Visible bleeding at a compressible site
   b. Reduction in blood pressure, localized pain, diaphoresis, or other signs of hypovolemic shock.

ii. If systemic bleeding is identified, blood work including a CBC, INR (PT), and fibrinogen, should be drawn [Strong recommendation; Moderate quality of evidence], with STAT results requested [Strong recommendation; Low quality of evidence].

iii. If systemic bleeding is identified, the intravenous thrombolysis infusion should be discontinued immediately if it is still running [Strong recommendation; Moderate quality of evidence].

iv. If there is visible bleeding (e.g., at the IV site, abrasion, epistaxis), compression should be applied, and the application of ice considered [Strong recommendation; Moderate quality of evidence].

v. Patient should be transfused as required and according to local protocols [Strong recommendation; Low quality of evidence].

Section 5.6 Clinical Considerations

1. Hypertension with symptomatic ICH: In patients with secondary ICH who are hypertensive (>185/110 mm HG), blood pressure should be lowered, however, the specific target and duration of therapy are unknown at this time.

Box 5B Criteria for Intravenous Thrombolysis Treatment

Refer to Section 4.2 and Box 4A for detailed recommendations on neuroimaging-based selection criteria, and online Supplemental Materials for additional information.

While these criteria are designed to guide clinical decision-making, the decision to use thrombolysis should be based on the clinical judgment of the treating physician. The relative benefits of thrombolysis versus potential risks or contraindications should be weighed on an individual basis.

Inclusion Criteria

Patients should be considered eligible for intravenous thrombolysis and/or EVT if they fulfill the following clinical criteria:

- Diagnosed with an acute ischemic stroke.
- The stroke is disabling (i.e., significantly impacting function), usually defined as National Institutes of Health Stroke Scale (NIHSS)>4.
- The risks and benefits of thrombolysis are within the patient's goals of care and take into consideration their functional status prior to stroke.
- Life expectancy of 3 months or more.
- Age ≥18 years. (Refer to pediatric guidelines for treatment <18 years of age).
  - For adolescents, a decision to administer intravenous thrombolysis should be based on clinical judgment; presenting symptoms; patient age; and, if possible, consultation with a pediatric stroke specialist.
- Time from last known well (onset of stroke symptoms) is <4.5 hours before thrombolysis administration. **For patients >4.5 hours refer to Section 5.1 for additional information.*

Absolute Exclusion Criteria

- Any source of active hemorrhage or any condition that could increase the risk of major hemorrhage after intravenous thrombolysis administration.
- Any hemorrhage on brain imaging.

Relative Exclusion Criteria (requiring clinical judgement based upon the specific situation. Consult Stroke Specialist at Comprehensive Stroke Centre if there are any questions or concerns about these criteria)

Historical

- History of intracranial hemorrhage.
- Stroke or serious head or spinal trauma in the preceding 3 months.
- Major surgery (e.g., cardiac, thoracic, abdominal, or orthopedic) in the preceding 14 days. Risk varies according to the procedure.
- Arterial puncture at a non-compressible site in the previous 7 days.

Clinical

- Stroke symptoms due to another non-ischemic acute neurological condition such as seizure with post-ictal Todd's paralysis or focal neurological signs due to severe hypo- or hyperglycemia.
- Hypertension refractory to aggressive hyperacute antihypertensive treatment such that target blood pressure <180/105 cannot be both achieved and maintained.

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5. Acute Ischemic Stroke Treatment Recommendations 2022

- Currently prescribed and taking a direct non-vitamin K oral anticoagulant. *Refer to Section 5.2 Clinical Considerations for additional information.*

CT or MRI Findings

- CT showing early signs of extensive infarction (e.g., >1/3 of middle cerebral artery [MCA] territory, or ASPECTS score <6).

Laboratory

- Blood glucose concentration <2.7 mmol/L or >22.2 mmol/L.
- Elevated activated partial-thromboplastin time.
- International Normalized Ratio >1.7.
- Platelet count <100,000 per cubic millimetre.

Box 5C Inclusion Criteria for Endovascular Thrombectomy

Refer to Section 4.2 and Boxes 4B and 4C for detailed recommendations on neuroimaging-based selection criteria.

Patients should be considered eligible for endovascular thrombectomy if they fulfill the following clinical criteria:

1. Diagnosed with an acute ischemic stroke.
2. The stroke is disabling (i.e., significantly impacting function), usually defined as National Institutes of Health Stroke Scale (NIHSS)>4.
3. There is a proven, clinically relevant (symptomatic), intra- or extracranial acute arterial occlusion that is amenable to endovascular intervention.
4. The risks and benefits of endovascular thrombectomy are within the patient's goals of care and take into consideration their functional status prior to stroke.
5. Age ≥18 years. (Refer to pediatric guidelines for treatment <18 years of age).
    a. Currently, there is no evidence for EVT in pediatric populations and the decision to treat should be based on the potential benefits and risks of the therapy, made by a physician with pediatric stroke expertise in consultation with the EVT provider and the patient and/or family or substitute decision-makers.
6. **Intravenous thrombolysis:** If intravenous thrombolysis is given in conjunction with endovascular thrombectomy, refer to Box 5B for additional inclusion criteria.
7. **Premorbid condition criteria**: In general, individuals considered eligible for EVT are those who were deemed functionally independent before their index stroke (i.e., mRS <3) and have a life expectancy >3 months. *Note: These criteria are based on major clinical trial inclusion criteria. Decisions should be based on these factors, clinical judgement, and the patient's goals of care.*
8. **Imaging:** Patients must qualify for imaging criteria in early and late windows as described in Boxes 4B and 4C.
9. **Time to treatment:** The decision to proceed with EVT should be shared by the physician with clinical stroke expertise and the neuro-interventionalist, who will use the available imaging information as is indicated.
    a. Specifically:
        i. Patients should have immediate neurovascular imaging (see above) to determine eligibility. Patients can be considered for imaging within a 24-hour window from stroke symptom onset or last known well.
        ii. For patients presenting <6 hours from stroke symptom onset or last known well to initiation of treatment (i.e., arterial puncture), all patients who meet eligibility criteria should be treated.
        iii. For patients presenting between 6 and 24 hours from last known well, selected patients may be treated if they meet clinical and imaging criteria and based on local protocols and available expertise in EVT.

Section 6: Acute Antiplatelet Therapy

Early antiplatelet therapy, provided soon after ischemic stroke, is known to improve outcomes. Acetylsalicylic acid (ASA) is the most commonly used agent. Results from two of the largest trials of ASA from several decades ago, the Chinese Acute Stroke Trial (CAST)[54] and the International Stroke Trial (IST)[55] represent the majority of the evidence base. In CAST, there were 5.4 fewer deaths and 4.7 fewer recurrent strokes per 1000 patients treated with daily aspirin of 160 mg after 4 weeks. In the aspirin arm of the factorial IST, patients with a suspected acute ischemic stroke received 300 mg/day of aspirin and a similar number avoided aspirin for 14 days. The risk of recurrent ischemic stroke was significantly lower in the aspirin arm, with a number needed to treat of 91, with no significant difference between groups in the frequency of symptomatic ICH.

Short-term DAPT, for up to 21 days following ischemic stroke, with either clopidogrel or ticagrelor is more effective than ASA alone in reducing the risk of recurrent ischemic stroke in selected patients. In the POINT trial, Johnston et al.[56] estimated that for every 1,000 patients treated with 75 mg clopidogrel plus 81 mg aspirin for 90 days, 15 ischemic strokes would be prevented but 5 major hemorrhages would result. The greatest protection from treatment was seen in the first 21 days during which the risk of a major ischemic event was lowered by 35%. Although the antiplatelet regimen in the CHANCE trial[57] was slightly different than in the POINT trial, the results were similar, in that the risk of recurrent ischemic stroke was reduced by 33% in the DAPT group.

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6. Acute Antithrombotic Therapy Recommendations 2022

6.1 Acute antithrombotic therapy *for patients not receiving intravenous thrombolysis*

i. All patients with acute ischemic stroke or transient ischemic attack (TIA) who are not already on an antiplatelet agent should be treated with at least 160 mg of acetylsalicylic acid (ASA) immediately as a one-time loading dose after brain imaging has excluded intracranial hemorrhage [Strong recommendation; High quality of evidence].

   a. For patients with delayed swallow screen or potential dysphagia, ASA (81 mg daily) or clopidogrel (75 mg daily) may be administered by enteral tube or ASA (325 mg daily) by rectal suppository [Strong recommendation; Moderate quality of evidence]. *Note: ASA and clopidogrel should only be administered orally once dysphagia screening has been performed and indicates an absence of potential dysphagia.*

ii. For endovascular thrombectomy (EVT) patients who did not receive intravenous thrombolysis and with no other contraindications, administration of an antiplatelet agent should not be delayed [Strong recommendation; Moderate quality of evidence].

iii. For patients with stroke who are discharged directly from the emergency department to the community, antiplatelet therapy should be started prior to discharge [Strong recommendation; Moderate quality of evidence].

6.1.1 Acute antithrombotic therapy *for patients receiving IV thrombolysis*

i. For patients receiving intravenous thrombolysis therapy, antiplatelet therapy should be avoided within the first 24 hours; antiplatelet therapy could then be initiated after brain imaging has excluded secondary hemorrhage [Strong recommendation; Moderate quality of evidence].
Refer to Secondary Prevention of Stroke module Sections 6 and 7 for additional information on antithrombotic therapy and anticoagulation for people with atrial fibrillation beyond the acute period.

6.2 Short-Term Dual Antiplatelet Therapy for Secondary Stroke Prevention

i. For patients with an acute high-risk TIA or minor ischemic stroke of non-cardioembolic origin (National Institutes of Health Stroke Scale [NIHSS] 0-3), who are not at high bleeding risk, dual antiplatelet therapy (DAPT) is recommended [Strong recommendation; High quality of evidence].

ii. Suggested regimens include at least:

   a. ASA 162 mg loading dose followed by ASA 81 mg daily plus clopidogrel 300-600 mg loading dose followed by clopidogrel 75 mg daily, for 21 days [Strong recommendation; High quality of evidence].

   OR

   b. ASA 162 mg load dose followed by ASA 81 mg daily plus ticagrelor 180 mg loading dose followed by ticagrelor 90 mg BID for 30 days [Strong recommendation; Moderate quality of evidence].

Note: The choice of the antiplatelet agent to add to ASA (i.e., clopidogrel or ticagrelor) should be based on individual patient and clinical factors, including the risk of moderate to severe hemorrhage described in the clinical trials.

iii. Use of dual antiplatelet therapy for longer than prescribed, as per 6.2ii/a and 6.2ii/b, following a TIA or minor stroke is ***not recommended*** unless there is a specific indication (e.g., arterial stent; symptomatic intracranial artery stenosis), due to an increased risk of bleeding [Strong recommendation; Moderate quality of evidence].

   a. Patients should be counselled that their dual antiplatelet regimen should be followed by single antiplatelet therapy with either ASA or clopidogrel indefinitely [Strong recommendation; High quality of evidence].

iv. Patients not meeting criteria for dual antiplatelet therapy should be initiated on a single antiplatelet agent within 24 hours of symptom onset. Suggested regimens include either:

   a. ASA 162 mg loading dose followed by 81 mg daily [Strong recommendation; High quality of evidence].

   OR

   b. Clopidogrel 300 to 600 mg loading dose followed by 75 mg daily [Strong recommendation; High quality of evidence].

6.3 Anticoagulation for Stroke Prevention

i. Patients with TIA who are found to have atrial fibrillation should receive oral anticoagulation instead of antiplatelet therapy [Strong recommendation; High quality of evidence] as soon as possible, and ideally within 24 hours of symptom onset [Strong recommendation; Moderate quality of evidence].

ii. Patients with stroke who are found to have atrial fibrillation should receive oral anticoagulation instead of antiplatelet therapy [Strong recommendation; High quality of evidence], with timing of initiation at the discretion of the physician based on patient-specific factors including size of infarct [Strong recommendation; Moderate quality of evidence].

Section 6 Clinical Considerations

1. Patients who are at a very high risk for TIA or minor ischemic stroke caused by high-grade carotid stenosis who are candidates for urgent carotid endarterectomy or carotid stenting should be reviewed with the surgeon or interventionalist to determine the appropriate timing and selection of antiplatelet agent(s).
2. For patients on dual antiplatelet therapy, gastrointestinal protection may be considered for those at higher risk of gastrointestinal bleeding.
3. For patients with acute stroke or TIA and non-valvular atrial fibrillation, anticoagulation should be initiated; however, there is a lack of randomized evidence to guide specific timing. According to expert consensus, a general approach to the target timing of initiation of DOAC therapy post-stroke is as follows:

   a. For patients with a brief TIA and no visible infarct or hemorrhage on imaging, anticoagulation may be started within the first 24 hours post-TIA.

   b. For patients with a minor clinical stroke/small non-hemorrhagic infarct on imaging, anticoagulation may be started 3 days post-stroke.

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6. Acute Antithrombotic Therapy Recommendations 2022

c. For patients with a moderate clinical stroke/moderate-sized infarct on imaging (without hemorrhage on CT), anticoagulation may be started 6 to 7 days post-stroke.

d. For patients with a severe clinical stroke/large-sized infarct on imaging (without hemorrhage on CT), anticoagulation may be started 12 to 14 days post-stroke.

e. Antiplatelet therapy may be used prior to initiating anticoagulation.

Refer to CSBPR Secondary Prevention of Stroke module Sections 6 and 7 for additional information on management of atrial fibrillation and choice of therapeutic agents.[13]

4. For patients who experience a stroke while receiving one antiplatelet agent, stroke etiology should be reassessed and addressed, and all other vascular risk factors aggressively managed. Continuing the current antiplatelet agent or switching to a different agent are reasonable options. At the time of writing, evidence is lacking to make more specific recommendations.

5. (NEW FOR 2022) Platelet function assays and pharmacogenetic testing may indicate antiplatelet activity and patients with potential clopidogrel resistance; however, the clinical implications for stroke prevention treatment are unclear at the time of writing and publication.

In the THALES trial,[1] patients with minor acute ischemic stroke treated with 90 mg ticagrelor twice a day + 75–100 aspirin mg/day also experienced fewer recurrent strokes and death within 30 days (5.5% vs. 6.6%, HR = 0.83, 95% CI 0.71–0.96, number needed to treat =92), compared with patients treated with aspirin alone.[1] However, these benefits were accompanied by a 3.5 to 4 times increased risk of severe or fatal bleeding and intracranial hemorrhage.

Section 7: Hemicraniectomy

Due to higher risks of cerebral edema, increased intracranial pressure, and subsequent cerebral herniation, mortality is higher for patients with malignant MCA stroke. For these patients, decompressive hemicraniectomy may be a surgical option. In persons under the age of 60 years, early decompressive hemicraniectomy increases the odds of a reasonable functional outcome (mRS score of 0–3) at 1 year.[58–60] The data are limited for patients over the age of 60 years. In the DESTINY 2 trial,[61] 82 patients with a median age of 70 years were randomized to hemicraniectomy or standard care: a significantly higher proportion of patients in the surgical group were alive and living without severe disability (mRS score of 0–4) at 6 months (38% vs.18%, OR = 2.91, 95% CI 1.06–7.49) compared with patients in the medical management group. However, no patients in either the surgical or medical care groups had overall good outcomes (mRS score of 0–2) at 6 or 12 months and most of the survivors required assistance with most bodily needs. In a recent systematic review, which included the results from seven trials, including DESTINY 2, as well as six trials of patients aged <60 years (DESTINY,[59] DESTINY II,[61] DECIMAL,[60] and HAMLET),[62] the odds of a favorable outcome (mRS 0–3) at 1 year were significantly higher in the surgical group (adjusted OR = 2.95, 95% CI 1.55–5.60) and the odds of death at 1 year were significantly lower (adjusted OR = 0.16; 95% CI 0.10–0.24).

7. Early Management of Patients Considered for Hemicraniectomy Recommendations 2022

7.1 Patient Selection

i. For patients aged 18 – 60 years old, hemicraniectomy should be considered as a life-saving measure for patients in the early stages of extensive (malignant) middle cerebral artery (MCA) territory ischemic stroke (defined as infarction size >50% MCA territory on visual inspection, or an ischemic lesion volume >150 cm^3 and concomitant clinical features) if patients or their substitute decision-makers are willing to accept a significant risk of living with a degree of disability that may leave them dependent on others for their activities of daily living. [Strong recommendation; High quality of evidence].

a. Hemicraniectomy could also be considered for patients aged 60 – 80 years [Conditional recommendation; Moderate quality of evidence].

ii. Posterior fossa decompression should be considered early in patients with significant cerebellar stroke with evidence of mass effect and/or hydrocephalus [Strong recommendation; Low quality of evidence].

iii. Patients at risk for malignant edema should have a consultation with a stroke specialist and neurosurgeon [Strong recommendation; Low quality of evidence].

a. If these services are not available on-site, patients should be considered for expedited transfer to a centre where advanced stroke care and neurosurgical services are available [Strong recommendation; Low quality of evidence].

7.2 Initial Clinical Evaluation

i. Urgent decisions regarding decompressive craniectomy should be undertaken based on discussions with patient, family members, and substitute decision-maker regarding a potential decompressive craniectomy [Strong recommendation; Low quality of evidence].

a. Patients with severe stroke due to large vessel occlusions may be at higher risk of developing malignant edema. In these patients, early discussions should be considered [Conditional recommendation; Low quality of evidence].

b. Key issues to be discussed with the patient, family members, and substitute decision-makers include stroke diagnosis and prognosis if untreated, the risks of surgery, the possible and likely outcomes following surgery including the odds of living with severe disability, and the patient's previously expressed wishes concerning treatment in the event of catastrophic illness [Strong recommendation; Low quality of evidence].

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7. Early Management of Patients Considered for Hemicraniectomy Recommendations 2022

7.3 Considerations Prior to Hemicraniectomy Surgery

i. Patients at risk of malignant edema should be monitored in an intensive care unit or neuro step-down unit [Strong recommendation; Low quality of evidence].

   a. Monitoring should include assessments of level of consciousness (e.g., Glasgow Coma Scale, Canadian Neurological Scale Score (CNS)), worsening symptom severity, and blood pressure at least hourly or more frequently if the patient's condition requires it [Strong recommendation; Low quality of evidence].

   b. If changes in status occur, the stroke team and neurosurgeon should be notified immediately for re-evaluation of the patient [Strong recommendation; Low quality of evidence]. Changes in status include level of drowsiness/consciousness, change in CNS score by ≥1 point, or change in National Institutes of Health Stroke Scale (NIHSS) score by ≥4 points [Strong recommendation; Low quality of evidence].

ii. In patients selected for decompressive craniectomy, surgery should be performed within 48 hours from stroke onset, and ideally before clinical deterioration occurs [Strong recommendation; Moderate quality of evidence].

iii. Patients with suspected elevation in intracranial pressure may be managed according to institutional protocols (e.g., administration of hyperosmolar therapy, head of bed elevation) [Conditional recommendation; Low quality of evidence].

Section 7 Clinical Considerations:

1. Global disability and quality of life outcomes are similar regardless of whether the hemicraniectomy was for right or left sided MCA infarction.
2. Whereas age alone is not a reason to forego hemicraniectomy, the DESTINY II trail reported that for 0% of patients over 60 years had mild or no disability (mRS of 0 – 2), and only 7% could function independently (mRS 0-3) after hemicraniectomy surgery.

Section 8: Acute Stroke Unit Care

Patients who are admitted to stroke units are more likely to survive, return home, and regain their independence compared to patients who are admitted to non-specialized units. The most recent update of the Stroke Unit Trialists' Collaboration[63] identified 29 randomized and quasi-randomized trials, including 5,902 participants, comparing stroke unit care with alternative, less organized care (e.g., an acute medical ward). Compared to less organized forms of care, stroke unit care was associated with a significant reduction in the odds of death (OR = 0.76, 95% CI 0.66 to 0.88), a poor outcome (OR = 0.77, 95% CI 0.69 to 0.87), and death or dependency (OR = 0.75, 95% CI 0.66 to 0.85) at a median follow-up of 1 year. These results were based on moderate quality evidence. Stroke unit care was superior regardless of age, sex, initial stroke severity, stroke type, trial quality, and duration of follow-up. In Canada, access to stroke unit care varies by region. A survey conducted in 2013/14 identified 32 stroke units within the province of Ontario, of which 21 were acute stroke units, 10 were integrated stroke units, and 1 which was classified as a rehabilitation stroke unit.[64] The estimated average number of stroke patients served per stroke unit was 604 with large variation across centers.

8. Acute Stroke Unit Care Recommendations 2022

8.1 Patients admitted to hospital with an acute stroke or transient ischemic attack (TIA) should be treated on an inpatient stroke unit [Strong recommendation; High quality of evidence] as soon as possible; ideally within 24 hours of hospital arrival [Strong recommendation; Low quality of evidence].

i. All efforts should be made to admit patients to an acute stroke unit, which is a specialized, geographically defined hospital unit dedicated to the management of patients with stroke [Strong recommendation; High quality of evidence].

   a. Facilities without a dedicated stroke unit must strive to focus care on the priority elements for comprehensive stroke care delivery, including clustering patients, having an interdisciplinary team, providing access to early rehabilitation, using stroke care protocols, conducting case rounds, and providing patient education [Strong recommendation; Moderate quality of evidence].

   Note: Stroke unit care is the gold standard for care following acute stroke. Alternate models may be discussed with system planners and should only be considered if it is not possible to create or access a stroke unit. Refer to online Supplemental Materials Box 8A Optimal Acute Inpatient Stroke Care for additional information.

ii. The core interdisciplinary stroke team should consist of healthcare professionals with stroke expertise including physicians, nurses, occupational therapists, physiotherapists, speech-language pathologists, social workers, dietitians, patients, and family members [Strong recommendation; High quality of evidence], who are ideally available seven days a week [Strong recommendation; Low quality of evidence].

   a. All interdisciplinary stroke teams should include hospital pharmacists to promote patient safety; conduct medication reconciliation; provide education to the team and patients and families about medications and their side effects, adverse effects, and interactions; promote adherence; and participate in discharge planning which could include addressing special needs for patients, such as individual dosing packages [Strong recommendation; Moderate quality of evidence].

   b. Additional members of the interdisciplinary team may include discharge planners or case managers, (neuro)psychologists, palliative care specialists, recreation and vocational therapists, spiritual care providers, peer supporters, and stroke recovery group liaisons [Strong recommendation; Moderate quality of evidence].

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8. Acute Stroke Unit Care Recommendations 2022

c. The patient and family should be included as part of the core team [Strong recommendation; Low quality of evidence].

d. All professional members of the interdisciplinary stroke team should have specialized training in stroke care and recovery [Strong recommendation; Moderate quality of evidence].

iii. The interdisciplinary stroke team should assess all patients as soon as possible after admission to hospital, and ideally within 48 hours, and formulate a management plan [Strong recommendation; High quality of evidence].

iv. Assessments of impairment, functional activity limitations, role participation restrictions, and environmental factors should be conducted using standardized, valid assessment tools [Strong recommendation; Moderate quality of evidence].

a. Patients should be assessed for areas such as dysphagia, mood and cognition, mobility, functional assessment, temperature, nutrition, bowel and bladder function, skin breakdown, vision, apraxia, neglect, and perception [Strong recommendation; Moderate quality of evidence]. *Refer to Section 9 Inpatient Prevention and Management of Complications Following Stroke for additional information.*

b. Patients should have a formal and individualized assessment to determine the type of ongoing post-acute rehabilitation services they require as soon as their status has stabilized, and within the first 72 hours post-stroke, using a standardized protocol [Strong recommendation; Moderate quality of evidence]. *Refer to CSBPR Rehabilitation and Recovery Following Stroke module[29] Section 3 for additional information.*

c. Tools should be adapted for use with patients who have communication differences or limitations as required [Strong recommendation; Moderate quality of evidence].

v. Discharge planning discussions, prevention therapies, and venous thromboembolism prophylaxis should be initiated soon after arrival on the acute stroke unit [Strong recommendation; Moderate quality of evidence]. *Refer to Section 9 Inpatient Prevention and Management of Complications Following Stroke for additional information.*

8.2 Management of Stroke Occurring While Patient is Already in Hospital

i. Patients who experience onset of signs and symptoms of a new acute stroke while already in hospital should have an immediate assessment by a physician with stroke expertise, undergo neurovascular imaging without delay, and be assessed for eligibility for intravenous thrombolytics and/or endovascular thrombectomy [Strong recommendation; Moderate quality of evidence]. *Refer to Section 4 Emergency Department Evaluation and Management of Patients with TIA and Acute Stroke, and Section 5 Acute Ischemic Stroke Treatment, for additional information.*

ii. All hospitals should have protocols to manage acute inpatient stroke, and all staff should be familiar with these protocols, especially in units with higher risk patients [Strong recommendation; Moderate quality of evidence].

8.3 Virtual Inpatient Stroke Care

i. Virtual stroke care modalities should be considered to support optimal in-hospital stroke care when patients cannot be transferred to an acute stroke unit (i.e., virtual stroke unit care) including support for medical decision-making and rehabilitation treatment [Conditional recommendation; Low quality of evidence]. *Refer to the CSBPR Virtual Stroke Care Implementation Toolkit for additional information, available at http://www.strokebestpractices.ca/.*

ii. Virtual care technology should be available to provide education to admitted patients and to staff working with patients, and to allow patients to access programs available at other locations if not available on-site, when safe to do so [Conditional recommendation; Low quality of evidence].

Section 9: Inpatient Prevention and Management of Complications Following Stroke 2022

Medical complications are relatively common following stroke and may negatively impact the recovery process, with the potential to result in poorer outcomes.[65] Estimates of the percentage of patients who experience at least one medical complication during hospitalization vary widely from 25%[66] to 85%.[67] Some of the most commonly cited complications include urinary tract infections, fever, pneumonia, and deep vein thrombosis (DVT). Examples of measures that can be taken to reduce the risks of these complications include pharmacological venous thromboembolism prophylaxis,[68] and the use of thigh-high intermittent pneumatic compression (IPC) devices,[69] to prevent thromboembolism, dysphagia screening to reduce the risk of pneumonia,[70] and the avoidance of the use of indwelling catheters to prevent urinary tract infections.[71] Early mobilization post-stroke can reduce the length of hospitalization and is associated with greater ability to perform activities of daily living at 3 months.[72] Cardiac investigations should also be conducted to identify previously undetected or paroxysmal atrial fibrillation, or other cardiac abnormalities.[73,74]

9. Inpatient Prevention and Management of Complications Recommendations 2022

9.0 Evidence-based investigations and management strategies should be implemented for all hospitalized stroke and transient ischemic attack (TIA) patients to optimize recovery, avoid complications, prevent stroke recurrence, and provide palliative care when required [Strong recommendation; Moderate quality of evidence].

i. During acute inpatient care, patients with stroke should undergo appropriate investigations to determine stroke mechanism and guide stroke prevention and management decisions [Strong recommendation; Moderate quality of evidence].

ii. Patients should be evaluated and treatment plans initiated for secondary prevention of vascular risk factors, including hypertension, diabetes, dyslipidemia and smoking cessation [Strong recommendation; Moderate quality of evidence]. *Refer to CSBPR Secondary Prevention of Stroke module for additional information.*[13]

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9. Inpatient Prevention and Management of Complications Recommendations 2022

iii. Individualized care plans should address nutrition, oral care, mobilization, and incontinence, and reduce the risk of complications such as urinary tract infection (UTI), aspiration pneumonia, and venous thromboembolism [Strong recommendation; Moderate quality of evidence].

iv. Transition planning should begin as a component of the initial admission assessment and continue throughout hospitalization as part of ongoing care of patients with acute stroke [Strong recommendation; Moderate quality of evidence]. *Refer to CSBPR Transitions and Community Participation Following Stroke module[43] Section 3 for additional information.*

v. All patients, family members, and informal caregivers should receive timely and comprehensive information, education, and skills training about stroke from interdisciplinary team members [Strong recommendation; Moderate quality of evidence]. *Refer to CSBPR Transitions and Community Participation Following Stroke module[43] Sections 1 and 2 for additional information.*

vi. Patients should undergo an initial screening for depression, including screening for a history of depression [Strong recommendation; Moderate quality of evidence]. *Refer CSBPR Mood, Cognition and Fatigue[75] Section 1 for additional information.*

vii. Stroke assessments should include evaluation of risk factors for depression, particularly a history of depression [Strong recommendation; Low quality of evidence].

viii. Patients should undergo an initial screening for vascular cognitive impairment when indicated [Strong recommendation; Moderate quality of evidence]. *Refer to CSBPR Mood, Cognition and Fatigue[75] Section 2 for additional information.*

9.1 Cardiovascular Investigations

i. Patients with suspected ischemic stroke or TIA should have a 12-lead electrocardiogram (ECG) to assess for atrial fibrillation, concurrent myocardial infarction, or structural heart disease (e.g., left ventricular hypertrophy) as potential causes of or risk factors for stroke [Strong recommendation; Moderate quality of evidence].

ii. For patients being investigated for an acute embolic ischemic stroke or TIA, ECG monitoring for 24 hours or more is recommended as part of the initial stroke work-up to detect paroxysmal atrial fibrillation in patients who would be potential candidates for anticoagulant therapy [Strong recommendation; High quality of evidence].

iii. For patients being investigated for an acute embolic ischemic stroke or TIA of undetermined source ***whose initial short-term ECG monitoring does not reveal atrial fibrillation*** but a cardioembolic mechanism is suspected, prolonged ECG monitoring for at least 2 weeks is recommended, as soon as practically possible, to improve detection of paroxysmal atrial fibrillation in selected patients ≥55 years who are not already receiving anticoagulant therapy but would be potential anticoagulant candidates [Strong recommendation; High quality of evidence]. *Refer to CSBPR Secondary Prevention of Stroke module[13] for additional information.*

iv. Routine echocardiography is not recommended for all patients with stroke. Echocardiography should be considered for patients with an embolic ischemic stroke or TIA of undetermined source, or when a cardioembolic etiology or paradoxical embolism is suspected [Strong recommendation; Moderate quality of evidence].

v. For patients ≤60 years who are being investigated for an embolic ischemic stroke or TIA of undetermined source, echocardiography with saline bubble study is recommended for detection of a patent foramen ovale (PFO) if it may change patient management (i.e., in patients who would be potential candidates for PFO closure or anticoagulant therapy if a PFO were detected) [Strong recommendation; Moderate quality of evidence].

   a. Contrast-enhanced (agitated saline) transesophageal echocardiography or transcranial Doppler has greater sensitivity than transthoracic echocardiography for detection of right-to-left cardiac and extra-cardiac shunts and should be conducted when available [Strong recommendation; Moderate quality of evidence].

9.2 Venous Thromboembolism Prophylaxis

i. All patients with stroke should be assessed for their risk of developing venous thromboembolism (deep vein thrombosis [DVT] and pulmonary embolism [PE]). ***Patients at high risk*** include those who are unable to move one or both lower limbs; those who are unable to mobilize independently; those with a previous history of venous thromboembolism, those who are dehydrated; and those with comorbidities such as active or suspected malignancy [Strong recommendation; Moderate quality of evidence].

ii. Patients at high risk of venous thromboembolism should be started on thigh-high intermittent pneumatic compression (IPC) devices or pharmacological venous thromboembolism prophylaxis (e.g., low molecular weight heparin [LMWH] or unfractionated heparin [UFH]) beginning on day of admission if there is no contraindication (e.g., systemic or intracranial hemorrhage) [Strong recommendation; High quality of evidence]. At present, there is no direct evidence to suggest the superiority of one approach over the other.

   a. Intermittent pneumatic compression devices should be discontinued when the patient becomes independently mobile, at discharge from hospital, if the patient develops adverse effects, or by 30 days, whichever comes first [Strong recommendation; Moderate quality of evidence].

iii. Graduated compression stockings are not recommended for deep vein thrombosis prevention [Strong recommendation; High quality of evidence].

iv. For patients with stroke admitted to hospital and who are immobile for >30 days, the use of ongoing venous thromboembolism prophylaxis (e.g., with pharmacological venous thromboembolism prophylaxis) is recommended [Strong recommendation; Low quality of evidence].

v. If intermittent pneumatic compression is considered after the first 24 hours of admission, venous leg Doppler studies should be considered [Strong recommendation; Low quality of evidence].

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9. Inpatient Prevention and Management of Complications Recommendations 2022

Section 9.2 Clinical Consideration:

1. Use of LMWH or UFH should be weighed against the potential risk for intracerebral hemorrhage for each individual patient.

9.3 Temperature Management

i. Temperature should be monitored as part of vital sign assessments; ideally every 4 hours for the first 48 hours, and then as per ward routine or based on clinical judgment [Strong recommendation; Moderate quality of evidence].

ii. For temperature >37.5 Celsius, frequency of monitoring should be increased, temperature-reducing measures should be initiated, causes of possible infection such as pneumonia or UTI should be investigated, and antipyretic and antimicrobial therapy should be initiated as required [Strong recommendation; Moderate quality of evidence].

9.4 Mobilization

***Definition**: Mobilization is the process of getting a patient to move in the bed, sit up, stand, and eventually walk.*

i. All patients admitted to hospital with acute stroke should have an initial assessment, conducted by rehabilitation professionals, as soon as possible after admission and using a standardized tool [Strong recommendation; Moderate quality of evidence].

ii. Initial screening and assessment should be commenced as early as possible, and ideally within 48 hours of admission by rehabilitation professionals who are in direct contact with the patient [Strong recommendation; Moderate quality of evidence]. *Refer to the CSBPR Rehabilitation and Recovery Following Stroke module[29] for additional recommendations on mobilization following an acute stroke.*

iii. Rehabilitation therapy should begin as early as possible once the patient is determined to be medically able to participate in active rehabilitation [Strong recommendation; High quality of evidence].

iv. Early prolonged mobilization of patients within ***the first 24 hours*** *after* a stroke, especially a severe stroke, is not recommended [Strong recommendation; High quality of evidence].

v. Earlier mobilization may be reasonable for some patients with acute stroke (e.g., people with milder strokes or TIA) but caution is advised and clinical judgement should be used [Conditional recommendation; Low quality of evidence].

Note: Contraindications to early mobilization include, but are not restricted to, patients who have had an arterial puncture for an interventional procedure; or patients who have unstable medical conditions, low oxygen saturation, and/or lower limb fracture or injury.

Refer to CSBPR Rehabilitation and Recovery Following Stroke module for additional recommendations on mobilization following an acute stroke.[29]

9.5 Seizure Management

i. New-onset seizures in admitted patients with acute stroke should be treated using appropriate short-acting medications (e.g., lorazepam IV) if the seizures are not self-limiting [Strong recommendation; Moderate quality of evidence].

   a. Patients who have an immediate post-stroke seizure should be monitored for recurrent seizure activity [Strong recommendation; Low quality of evidence].

   b. Recurrent seizures in patients with ischemic stroke should be treated as per local treatment recommendations for seizures in other neurological conditions [Strong recommendation; Moderate quality of evidence].

ii. A single, self-limiting seizure occurring at the onset or within 24 hours after an ischemic stroke is considered an "immediate" post-stroke seizure and does not require long-term anticonvulsant medications [Conditional recommendation; Low quality of evidence].

iii. Prophylactic use of anticonvulsant medications in patients with ischemic stroke is not recommended [Strong recommendation; Moderate quality of evidence]

iv. Continuous or repeat electroencephalogram monitoring in patients with a stroke and unexplained reduced level of consciousness should be considered [Conditional recommendation; Moderate quality of evidence].

9.6 Nutrition and Dysphagia

i. Patients should be screened for swallowing impairment before any oral intake, including medications, food, and liquid, by an appropriately trained professional using a valid screening tool [Strong recommendation; Moderate quality of evidence].

ii. The swallowing, nutritional and hydration status of patients with stroke should be screened as early as possible, ideally within 24 hours of admission, using validated screening tools [Strong recommendation; Moderate quality of evidence].

iii. Abnormal results from the initial or ongoing swallowing screens should trigger a prompt referral to a speech-language pathologist, occupational therapist, dietitian, and/or other trained dysphagia clinicians for more detailed assessment and management of swallowing, feeding, nutritional, and hydration status [Strong recommendation; Moderate quality of evidence].

   a. An individualized management plan should be developed to address therapy for dysphagia, dietary needs, and specialized nutrition plans [Strong recommendation; Moderate quality of evidence].

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9. Inpatient Prevention and Management of Complications Recommendations 2022
iv. For patients who cannot safely swallow or meet their nutrient and fluid needs orally, enteral nutrition (e.g., nasogastric tube feeding) should be considered in consultation with the patient, family, or substitute decision-maker, and the interdisciplinary team as early as possible after admission, usually within the first three days of admission [Strong recommendation; Moderate quality of evidence]. *Refer to CSBPR Rehabilitation and Recovery Following Stroke module Section 7 for additional information on dysphagia screening, assessment, and management.*[29]
a. Nasogastric feeding tubes should be replaced by gastric-jejunum tube (GJ-tube) if the patient requires a prolonged period of enteral feeding [Strong recommendation; Moderate quality of evidence]
9.7 Continence
i. Indwelling catheters should be used cautiously due to the risk of UTIs [Strong recommendation; High quality of evidence].
a. If used, indwelling catheters should be assessed daily and removed as soon as possible [Strong recommendation; High quality of evidence].
b. Peri care and infection prevention strategies should be implemented to minimize risk of infection [Strong recommendation; Moderate quality of evidence]. *Refer to Section 4.6(iii) for additional information.*
ii. Patients with stroke should be screened for urinary incontinence and retention, with or without overflow; fecal incontinence; and constipation [Strong recommendation; Moderate quality of evidence].
iii. The use of a portable ultrasound machine is recommended as the preferred non-invasive method to assess post-void residual [Conditional recommendation; Low quality of evidence].
iv. Patients with stroke with urinary incontinence should be assessed by trained personnel using a structured functional assessment to determine cause and develop an individualized management plan [Strong recommendation; Moderate quality of evidence].
v. Patients with stroke with urinary incontinence should have a bladder-training program implemented [Conditional recommendation; Low quality of evidence].
a. The bladder training program should include timed and prompted toileting on a consistent schedule [Conditional recommendation; Moderate quality of evidence].
b. Appropriate intermittent catheterization schedules should be established based on amount of post-void residual [Conditional recommendation; Moderate quality of evidence].
vi. Patients with stroke with persistent constipation or bowel incontinence should have a bowel management program implemented [Strong recommendation; Moderate quality of evidence].
9.8 Oral Care
i. At or soon after admission, patients with stroke should have an oral/dental assessment, including screening for signs of dental disease, level of oral care, and appliances [Strong recommendation; Low quality of evidence].
ii. For patients with stroke wearing a full or partial denture it should be determined if they have the neuromotor skills to safely wear and use the appliance(s) [Strong recommendation; Low quality of evidence].
iii. For patients where there are concerns about oral hygiene and/or appliances, a referral to a dentist for consultation and management should be made as soon as possible [Strong recommendation; Moderate quality of evidence].
iv. Patients with stroke should receive oral care consistent with the Canadian Dental Association recommendations, and the oral care should address areas such as frequency of oral care (ideally after meals and before bedtime); types of oral care products (toothpaste, floss, mouthwash); and management for patients with dysphagia [Strong recommendation; Moderate quality of evidence].

Section 10: Advance Care Planning

Advance care planning (ACP) is a process of reflection and communication in which individuals reflect on their wishes and values to make decisions regarding their healthcare in consultation with healthcare providers, should they become incapable of participating in decision-making at a later date.[76] While there is evidence supporting ACP in the primary care setting, there are limited data on ACP in acute care in general, and even less following stroke. Green et al.[77] used participant observation and semi-structured interviews to gather information related to the communication process regarding ACP from 14 patients, recruited from an acute stroke unit and 2 rehabilitation units, and 4 HCPs. Four key themes emerged as to why or why not participants engaged in the ACP process. First, there was a perceived lack of urgency by participants, many of whom felt the physician and/or family members would make decisions in accordance with their wishes; second, there was a lack of initiation by HCPs to discuss issues around ACP; third, HCPs expressed hesitation about initiating discussions related to ACP, and uncertainty as the best timing for such discussions. Fourth, there was also a lack of understanding of ACP, especially as compared to advance directives, designation of care, and living wills.

Although no stroke-specific studies have been published that examine the effectiveness of ACP, several studies included patients with stroke. Results from a small number of studies suggest that interventions aimed at increasing ACP have been successful in significantly increasing the likelihood that end-of-life wishes are known and respected.[78,79]

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10. Advance Care Planning Recommendations 2022

Advance Care Planning

i. Persons with stroke, as well as their families and informal caregivers, should be approached by the interdisciplinary stroke team to participate in advance care planning (ACP) [Strong recommendation; Low quality of evidence].

ii. Respectful advance care planning should be integrated as part of a comprehensive care plan, taking into consideration values and preferences with information regarding the patient's illness, understanding, prognosis, medically appropriate treatments and future medical care [Strong recommendation; Low quality of evidence].

iii. Advance care planning may include identifying a substitute decision-maker (proxy, agent, or power of attorney), and discussing the patient's personal values and preferences to be applied in future if the need arises to make healthcare decisions or provide consent on behalf of the patient [Strong recommendation; Moderate quality of evidence].
   a. Advance care planning discussions should be documented and reassessed regularly with the active care team and substitute decision-maker, especially when there is a change in the patient's health status [Strong recommendation; Low quality of evidence].

Section 10 Clinical Considerations

1. The interdisciplinary stroke care team should have the appropriate communication skills and knowledge to respectfully address the physical, spiritual, cultural, psychological, ethical, and social needs of the person with stroke and their family and informal caregivers.
2. Ensure advance care planning discussions are individualized and culturally sensitive.
3. Processes should be established to support, patients, family and healthcare staff who are experiencing conflicts over advanced care decisions being made by the patient or substitute decision maker. Referrals can be made to social work, palliative care, spiritual care, and ethics.

Section 11: Palliative and End-of-Life Care

Palliative care is an approach that aims to reduce suffering and improve the quality of life for people who are living with life-limiting illness through the provision of pain and symptom management, psychological, social, emotional, spiritual, and practical support, and support for caregivers during the illness and after the death of the person they are caring for.[80] Palliative care provides comprehensive care throughout a person's illness trajectory and is not solely limited to end-of-life care. The role of palliative care may be complicated as prognosis in the earliest phase of stroke can be unclear.[81] There is currently no integrated model of palliative care in stroke care addressing the appropriate moment to initiate palliative care discussions[82] or which healthcare provider(s) should raise the topic; however, there is agreement that the approach should be interdisciplinary and patient- and family-centered. The palliative care needs of patients following stroke are typically related to the management of common symptoms such as dyspnea, pain, and xerostomia.[83] While palliative care pathways have been developed to ensure that patients receive the most appropriate care possible in the last days of life, there is an absence of high-quality evidence to suggest that current pathways are effective, highlighting the need for additional research in this area.[84] In terms of specific interventions designed to address many common palliative care issues, a systematic review by Cowey et al.[85] concluded that there was insufficient evidence to recommend the best and most effective approaches to this important and essential component of care.

11. Palliative and End-of-Life Care Recommendations 2022

Palliative and End-of-Life Care

i. A palliative approach should be used when there has been a catastrophic stroke or a stroke in the setting of significant pre-existing comorbidity, to optimize care for the patients, and their family members and informal caregivers [Strong recommendation; Low quality of evidence].

ii. The interdisciplinary stroke team should have discussions with the patient and decision-makers regarding the patient's goals of care that includes consideration of the patient's diagnosis, prognosis, values, wishes, and whether care should focus on comfort or on prolonging life [Strong recommendation; Low quality of evidence].
   a. There should be regular communication with the patient, family, and informal caregivers to ensure their goals and needs are being met [Strong recommendation; Low quality of evidence].
   b. Palliative and end-of-life discussions should be ongoing and take into account reflect any changes in diagnosis or prognosis [Strong recommendation; Low quality of evidence].
   c. Topics to be discussed with patients, families, and informal caregivers may include the appropriateness of life-sustaining measures, including mechanical ventilation, enteral/intravenous feeding, and intravenous fluids, and the purpose of all medications, including those for symptom management [Strong recommendation; Low quality of evidence].

iii. Palliative care discussions should be documented and reassessed regularly with the healthcare team and substitute decision-maker [Strong recommendation; Low quality of evidence].

iv. Patients, families, informal caregivers, and the healthcare team should have access to palliative care specialists, particularly for consultation about patients with difficult-to-control symptoms, complex or conflicted end-of-life decision-making, or complex psycho-social family issues [Strong recommendation; Low quality of evidence].

v. Decisions to initiate, withdraw, or forgo life-prolonging treatments after stroke, including artificial nutrition and hydration, should be made in discussion with the patient, family, and informal caregivers as appropriate, taking into account the best interests of the person, and including whenever possible their prior expressed wishes, either in an advanced care plan or through discussions [Strong recommendation; Low quality of evidence].

(*Continued*)

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(*Continued*)

11. Palliative and End-of-Life Care Recommendations 2022

vi. Each member of the healthcare team should understand their roles and responsibilities as defined by their respective provincial or territorial college or professional organization regarding discussions about MAiD [Strong recommendation; Low quality of evidence].

vii. Organ and tissue donation should be discussed with families and informal caregivers as appropriate [Strong recommendation; Low quality of evidence].

viii. Supportive counselling, funeral support, and bereavement resources should be provided to families and informal caregivers after the patient's death [Strong recommendation; Low quality of evidence].

Section 11 Clinical Considerations

1. The interdisciplinary stroke team should have the appropriate communication skills and knowledge to respectfully address the physical, spiritual, cultural, psychological, ethical and social needs of the person with stroke, their family and informal caregivers who are involved in the patient's end-of-life care.
2. For patients with stroke at the end of life, the following areas may be considered where appropriate (note, other areas may be relevant as well for each individual):
    a. Need for formal palliative care consultation
    b. Cessation of routine vital sign checks, blood work, and diagnostic tests
    c. Oral care
    d. Eye care
    e. Pain
    f. Delirium
    g. Respiratory distress and upper airway secretions
    h. Nausea and vomiting, incontinence and constipation,
    i. Skin and wound care
    j. Seizures
    k. Anxiety and depression. *Refer to CSBPR Mood, Cognition and Fatigue module Section 1 for additional information.*[75]
    l. Interdisciplinary support for patients, families, and caregivers during dying process
    m. Preferred location of palliative care (e.g., home, hospice, another supportive living environment)
    n. Preferred person to be notified of patient's death

Challenges and Future Directions

The 7th update of the *Canadian Stroke Best Practice Recommendations for Acute Stroke Management* provides a detailed series of recommendations applicable to the care of all adults in Canada who have sustained an ischemic stroke or TIA. These guidelines have been developed through a rigorous process; efforts must now turn to their rapid implementation, especially of the new recommendations, based on emerging high-quality evidence, so as to increase equitable access to timely acute stroke care for all people in Canada.

This edition of the guidelines has incorporated Tenecteplase 0.25 mg/kg as an alternate thrombolytic for acute ischemic stroke based on the landmark Canadian AcT trial. It is expected that the knowledge of the clinical applications of tenecteplase will continue to advance, particularly as it pertains to its use in the setting of patients with intracranial arterial occlusions who may or may not be candidates for thrombectomy.

Thrombectomy with or without thrombolysis is the topic of several recent randomized trials; this issue will likely be settled by the time the next edition of these guidelines is ready for publication. At present, trials that most closely reflect Canadian practice suggest that thrombolysis should NOT be withheld for patients who are also candidates for thrombectomy; all eligible patients should receive thrombolysis, regardless of whether they also may receive thrombectomy. We acknowledge the possibility that further refinement in the understanding of the risks and benefits of combination therapy could alter these recommendations. Specifically, it is anticipated that further experience with tenecteplase may impact this calculus in important ways.

We are also excited about the prospect of further developments in the evidence to support EVT for patients with acute ischemic stroke of the posterior circulation. These patients were excluded from the landmark thrombectomy trials published between 2014 and 2018, and upon which current recommendations are based. With the advent of data from high-quality randomized trials, we expect to be able to provide more specific recommendations about thrombectomy for patients suffering strokes of the posterior circulation in the next edition of these guidelines.

The field of neuroprotection is also likely to advance in the coming years. The ESCAPE NA-1 trial suggested that nerinetide could be an effective neuroprotectant in patients with acute ischemic stroke not receiving thrombolysis, and that hypothesis is currently being tested in the Canadian-led ESCAPE NEXT trial. If that trial should be successful, it will be the first instance in the history of clinical neuroscience that a neuroprotectant agent has been found to be clinically effective in humans. Such a discovery could have significant ramifications for the management of acute ischemic stroke and may also influence the care of patients with ICH, subarachnoid hemorrhage, traumatic brain injury, and cardiac arrest.

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The advent of mobile stroke units suggests radical change in the way acute stroke care could be delivered, at least for some people in Canada. While high-quality randomized trials in the USA, Germany, and Australia have suggested that mobile stroke units reduce time to treatment, increase treatment eligibility, and lead to better outcomes, we do not feel able to provide specific recommendations for Canadian practice until real-world research addresses our political, economic, and geographic realities. We hope that further research will help to address the question of how mobile stroke units may contribute to the further optimization of stroke care in Canada.

Lastly, at this time, our knowledge of sex and gender differences in acute stroke is evolving. In addition to pregnancy and hormone therapy, the prevalence of risk factors such as hypertension and atrial fibrillation are higher in women. Stroke symptom severity, presentation, and treatment effectiveness are areas that require further research.

The focus throughout these guidelines and stroke systems development in Canada and globally has been on an integrated system to provide seamless care to the patient with vascular risk factors and multimorbidity. Such an approach requires coordinated systems to be in place in all regions of Canada; a challenge given its vast geographical area with many smaller isolated communities. Quality monitoring and efforts to improve care are ongoing, and these recommendations will be updated within the next several years as new evidence emerges.

Supplementary material. To view supplementary material for this article, please visit https://doi.org/10.1017/cjn.2022.344.

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